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ERRATA

In Abstract 3-520, Nuclear Science Abstracts 3, 126 (1949) Aug. 15, substitute 26 μc and 260 μc (microcuries) for 26 mc and 260 mc (millicuries), respectively.

Abstract No. 4135 (NSA 4-4135) was incorrectly listed as No. 4235.

The last three lines in NSA 4-4378 are in error. This portion of the abstract should read: Mechanical properties of the scrap iron-limonite concrete are satisfactory for structural purposes. From the practical cost standpoint, a concrete made entirely of limonite ore is shown to be a reasonable compromise. (auth)

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U. S. ATOMIC ENERGY COMMISSION DECLASSIFIED DOCUMENTS

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AECD-2859	Some Physical Aspects of the Effects of Beta Radiation on Tissue. H. M. Parker.	5092

U. S. ATOMIC ENERGY COMMISSION UNCLASSIFIED DOCUMENTS

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AECU-839	The Kinetics of Exchange Reaction Between the Two Oxidation States of Cerium in Acid Solution. J. W. Gryder and R. W. Dodson.	5200
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AECU-849	The Irradiation of Small Volumes by Contained Radioactive Isotopes. P. I. Richards and B. A. Rubin.	5093
AECU-850	The Economic Integration of Radiological Safety into the Industrial Safety Program. Julius Hannoch.	5113
AECU-851	Retention of Beryllium in Animal Tissues Following Inhalation of its Salts. H. E. Stokinger, L. T. Steadman, and R. E. Root.	5130
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AECU-866	Synchrotron-Oscillation Resonance. N. M. Blachman.	5308
AECU-867	The Epimerization of Glucose-1-C^{14}. A. A. Bothner-By and M. Gibbs.	5210
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UCLA-74	The Excretion Kinetics of the Dye T-1824 in Relation to Plasma Volume Determinations. A. E. Lewis and R. D. Goodman.	5087
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UCRL-749	The Utilization of the Branched Chain of Isobutyric Acid Studied with C^{14}. I. Gray, P. Adams, and H. Hauptmann.	5138
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UCRL-763	Screening of Potential Cancer-Inhibiting Agents. M. Gordon, J. B. Siri, J. G. Campbell, and M. Calvin.	5088

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5083 The Relationship of Lysozyme to Other Components of Gastric Secretion in Peptic Ulcer. Robert W. Reifenstein, Howard M. Spiro, J. C. Gordon Young, Edward P. Connelly, and Seymour J. Gray. AECU-853, nd. 28p.

The lysozyme content of the gastric juice of patients with duodenal ulcer and gastric ulcer did not exceed that found in normal subjects. Histamine and insulin produced a fall in the lysozyme concentration and total lysozyme output in the gastric juice of normal subjects and patients with peptic ulcer. High gastric acidity (pH of 1.5 or less) was associated with an inhibition of lysozyme activity. Gastric pepsin did not inhibit lysozyme activity. The lysozyme content of gastric juice appeared to vary directly with the mucoproteose content and inversely with the muceprotein content, suggesting that lysozyme had its origin within the surface epithelial cells of the stomach. An increase in tissue lysozyme was found at the margin of active gastric ulcers. The tissue lysozyme was normal, however, at the border of inactive chronic gastric ulcers. The tissue lysozyme titer appeared to parallel the course and activity of the disease process and reflected the tissue response to injury. Evidence was presented indicating that lysozyme does not play a significant role in the etiology of peptic ulcer.

5084 The Effects of Mercurial Compounds on Invertase. C. L. Gemmill and E. M. Bowman. AECU-854, nd. 22p.

The effects of several mercury compounds of pharmacological interest on invertase and the effect of thiol compounds on these reactions have been studied by the methods of Lutz and Nelson (J. Biol. Chem. 107, 169(1934)). Mercuric chloride, merbromin, thiomerin, and mercurin were found to be strong inhibitors of invertase. The inhibition produced by mercuric chloride is competitive. The inhibition of invertase by mercuric chloride may be reversed by 2,3-dimercapto-propanol. Invertase may be added to the list of enzymes which may be inactivated by mercurials and reactivated by 2,3-dimercapto-propanol. This enzyme has the novel property of having the mercuric chloride inhibition augmented by cysteine and glutathione.

5085 The Photochemical Reduction and Dark Reoxidation of Cytochrome C by Chloroplast Preparations. A. S. Holt. ORNL-752, July 14, 1950. 19p.

Illuminated chloroplasts can reduce oxidized cytochrome c in vitro. In darkness, it is found that reduced cytochrome is reoxidized by a thermolabile component in chloroplast preparations. The rate of reoxidation of reduced cytochrome c is inhibited by cyanide, azide, and carbon monoxide. Photochemical reversal of the inhibition by CO was not demonstrated. Between the ranges 15 and 35°C the rate of oxidation is increased with a temperature coefficient of 2. At 45°C immediate deleterious effects were evident. Centrifugation procedures did not yield any sharply defined separation of oxidase and photochemical activity. 10 references. (auth)

5086 Dye Reduction by Illuminated Chloroplast Fragments. A. S. Holt, R. F. Smith, and C. S. French. ORNL-753, July 14, 1950. 26p.

The rate of reducing of dilute solutions of indophenol dyes, approximately 1.0 to 3.0 × 10^{-5} M, can be used as a quantitative index of the photochemical activity of micro quantities of chloroplast material. The initial rate of dye reduction can be measured within a period of 1 min with a precision of ±2% using a photometric method and continuous recorder. Less rapid and more scattered results are obtained when visual estimates of the time required for complete decolorization are used. Reduction of 2,6 dichlorobenzenone indo-3′-chlorophenol is maximum at pH 5.9. The temperature coefficient for reduction of this dye is ~1.7 for the temperature range 5 to 35°C. Precipitation, adsorption, and differential centrifugation of preparations of chloroplasts disintegrated by supersonic vibrations failed to yield any fractions possessing noteworthy increases in photochemical activity. 12 references. (auth)

5087 The Excretion Kinetics of the Dye T-1824 in Relation to Plasma Volume Determinations. Alvin E. Lewis and Raymond D. Goodman. UCLA-74, May 26, 1950. 14p.

In order to eliminate the effects of mixing time in estimating plasma volume by dye dilution methods, a constant infusion technique employing the dye T-1824 has been used. The calculation is based on the rate of change in dye concentration during the infusion. Allowance for excretion rate in this calculation is made by determining the rate of fall in plasma concentration after the infusion is stopped. Since mixing occurs continuously its effect is eliminated. The results obtained with 10 rabbits indicate that (1) in this animal mixing time is negligible, and (2) the rate of excretion is so slow that extrapolations of plasma concentration after a single injection on the basis of a straight line or of a flattened portion of an exponential curve are not distinguishable. (auth)

5088 Screening of Potential Cancer-Inhibiting Agents. Maxwell Gordon, Jean B. Siri, Jane G. Campbell, and Melvin Calvin. UCRL-763, June 22, 1950. 8p.

One [3′,2′-H]-thiazolinopurine and 10 purines and pyrimidines, which were prepared as thiazolinopurine intermediates, were screened for possible cancer-inhibiting action. C57 black mice bearing myeloid leukemias (C1498) were utilized. The possible cancer-inhibiting action of 6 of the compounds was also tested on C57 mice bearing adenocarcinomas (Eo771). None of the compounds prepared in this program to date exhibited any cancer-inhibiting action. (auth)

5089 The Surface Chemistry of Bone. II. Fluoride Deposition. W. F. Neuman, M. W. Neuman, E. R. Main, J. O'Leary, B. J. Mulryan, and F. A. Smith. UR-114, Apr. 26, 1950. 13p.

The mechanism of fluoride deposition in bone was investigated by means of isotopic exchange, ion competition, and column techniques. It was demonstrated that fluoride replaces either hydroxyl or bicarbonate ions in the surfaces of the mineral phase. The results offer a sound experimental basis for the use of bone ash and synthetic apatites as reversible exchange-adsorbers for fluoride on a commercial scale. 17 references. (auth)

5090 An Apparatus for Pipetting Radioactive Solutions. A. F. Graham. J. Lab. Clin. Med. 36, 146-7(1950) July.

A device which has been found useful for the accurate and safe pipetting of tracer amounts of radioactive solutions in studies on the uptake of radioactive phosphorus by influenza virus is illustrated and described. It has been found in

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practice that the accuracy and control over liquid flow are equivalent to those in normal pipeting technique. Since it is not essentially an apparatus for protection from radiation, this device should be used only for pipetting tracer amounts of radioactive solutions.

5091 Atomic Energy and the Life Sciences. U. S. Atomic Energy Commission. Washington, Government Printing Office, 1949. 203p.

This volume outlines the program of biological and physical research at the various national laboratories under the supervision of the Atomic Energy Commission. Other activities of the Atomic Energy Commission such as the dissemination of scientific information, the fellowship program, the sale of radioisotopes are included. Appendixes list the participating universities, the members of the various committees included in the Atomic Energy Commission, contract arrangements, etc.

5092 Some Physical Aspects of the Effects of Beta Radiation on Tissue. H. M. Parker. AECD-2859, Sept. 10, 1943, Decl. June 20, 1950. 55p.

This report is concerned with the determination of the depth in tissue at which damage by beta radiation can occur, and the calculation and measurement of beta radiation doses in the superficial tissue arising from exposure to various distributions of beta emitters. Part I is devoted to the calculation of dosages and Part II deals with the experimental methods and techniques used in beta radiation dosage determinations.

5093 The Irradiation of Small Volumes by Contained Radioactive Isotopes. Paul I. Richards and Benjamin A. Rubin. AECU-849, nd. 24p.

Calculations of radiation dosage from internal radioactive substances are important to those who would study the biological effects of radioactive decay within a living organism, and to those who wish to irradiate tiny particles in a small volume of a radioactive solution. Such dosage calculation may also be important in tracer studies where there is great selective concentration in a small sensitive area. The present calculations have been approached with a consideration of past presentations of similar problems. It has been assumed previously that the total energy of α or β particles is absorbed in all volumes usually studied. In many cases this is far from true, but in order to utilize the valuable portions of previous calculations, the dosage has been considered here in terms of the fraction F of the total ionizing energy arising in volumes containing radioactive substances. One need only calculate the integrated total energy of the emissions (in the manner of previous studies) and then subtract the appropriate F. The nonuniformity of dose within the volume can also be considered by methods previously described. Solutions are presented for several useful geometric types that may be encountered in biological experiments. In one case, cognizance is taken of the fact that energy is not lost uniformly by these "rays." Although this is usually true in experiments with β emitters, all problems could not be solved with this added complexity. But by means of some general expressions and a correction curve it is possible to obtain an accurate solution to most small-volume problems.

Special corrections may be necessary in cases where backscatter or inhomogeneity is important, but these must be evaluated individually; useful solutions are possible, employing previously described methods. 10 references. (auth)

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5094 Effect of "Alphatron" and Other Radioactive Materials on Germination and Early Growth of Various Crops. E. H. Toole, Vivian K. Toole, J. M. Power, Victor J. Kilmer, and L. T. Alexander. AECU-852, Apr. 24, 1950. 12p.

The effect of alphatron (α-emitting material) on germination and early growth of seedlings of wheat, alta fescue, soybean, cucumber, cabbage, radish, tomato, pepper, and corn was studied. The results indicated no consistent trend of any effect either on amount of germination or on early growth of the young seedlings.

5095 The Survival of Mice Under Duration-of-Life Exposure to X Rays at Various Dose Rates. George A. Sacher. CH-3900, Apr. 1950. 43p.

The survival of two strains of mice is reported for dose rates extending from 20 to 1000 r/day. The relations between mean survival time, mean accumulated dose, and dose rate are exhibited. The relation of repeated-dose lethality to single-dose lethality is investigated and the quantitative consistency is discussed. The hypothesis of a lethality process is introduced. On this hypothesis a lethality function is deduced, and its characteristics discussed. The deduction of the lethality function required certain mediating assumptions about linearity and about the properties of a defined lethal bound of injury. These assumptions are discussed. Applications of the conceptions developed are considered briefly. 18 references. (auth)

5096 A Factor in the Plasma of the Irradiated Rat Which Changes the A/G Ratio. Elliot Volkin and Henry L. Kohn. ORNL-734, July 10, 1950. 16p.

Total-body x-irradiation (250 kvp) of the rat caused a rise in the serum or plasma albumin-globulin (A/G) ratio. The effect was maximal 4 days after exposure to about 700 r. The rise was found when the A/G ratio was determined by sodium sulfate fractionation or by the analytical ultracentrifuge, but not by electrophoresis. Ether extraction of the plasma just prior to analysis returned the elevated value of A/G to normal. A substance was obtained from alcohol-ether extracts of plasma or serum which raised the A/G ratio of normal rat serum or plasma in vitro. 12 references. (auth)

5097 Action of Ionizing Rays upon Antigen Vi of Salmonella typhy (Inagglutinable O and Agglutinable Vi). A. Jude, P. Bonet-Maury, and P. Servant. Compt. rend. soc. biol. 144, 214-16(1950) Feb. (in French).

In this note the action of the α particles of Rn upon antigen Vi of Salmonella typhy is recorded. Antigen Vi preserved its serological characteristics even at elevated doses of radiation. Radiation dosages up to 40 μ cd/cm^3, nearly 3 times the sterilizing dose, were used. Neither inagglutinable antigen O nor agglutinable antigen Vi were destroyed.

5098 The Action of Radon Rays on the Antigenic Power of Salmonella ballerup (the Production of Agglutinant Antibodies). P. Servant, P. Bonet-Maury, and A. Jude. Compt. rend. soc. biol. 144, 216-17(1950) Feb. (in French).

Rabbits received 3 injections at 7 day intervals of an aqueous suspension of S ballerup, having previously irradiated it sufficiently to destroy its reproductive ability. The results obtained confirmed the fact that antigens Vi and H are thermolabile and antigen O is thermostable. It appears

that the α rays of radon do not affect the antibody producing powers of antigens Vi, O, and H.

5099 The Additive Action of Methylcholanthrene and X Rays on the Guinea Pig. P. Mendeleeff. Compt. rend. soc. biol. 144, 301-2(1950) Feb. (in French).

Previous attempts by the writer to induce cancer in guinea pigs with methylcholanthrene were unsuccessful. Massive doses of x-rays or radium alone would only produce radiodermatitis which occasionally would be transformed into a malignant tumor. The author injected four guinea pigs subcutaneously with 30 mg methylcholanthrene and exposed them 5 to 6 days later to 400 r at 85 kv at the place of injection. Three of the animals exhibited tumors, two of which were cancerous. These tumors occurred with prior radiodermatitis.

5100 The Biological Significance of the Roentgen. A. Mutscheller. J. Investigative Dermatol. 14, 471-81(1950) June.

Experiments were performed on the depth of penetration of x-rays into human tissue and the resulting erythema was noted. By placing a layer of ground beef of known thickness in contact with the skin and applying a known sufficiently large radiation quantity to the surface of the ground beef to produce a distinctly visible erythema, the skin becomes a reagent for or an indicator of biological radiation effects. The radiation penetrating through the superimposed ground beef and through the skin produces photo rays and scattered components of secondary rays which are propagated in all directions, except that the scattered secondary rays have a larger forward than backward component. If the skin is covered with a rather large thickness of ground beef, which has the same effect upon the incident radiation as the skin and the subcutaneous tissues, or if the biological effectiveness is determined at a locus sufficiently deep in the volume of the irradiated tissues, the secondary components in the forward and the backward direction are equal, and it is then that secondary ray equilibrium exists. Determinations were also made on the radiation dose on the skin on the exit side. The analysis of the biological utilization of primary and secondary x-rays leads to the concept that a secondary ray equilibrium exists in a centrally located region of an exposed tissue volume, wherein the secondary radiation from other cells reaching a small volume or a cell is equal to the secondary ray quantity emitted from this small volume or cell. 10 references.

5101 The Cancer-Producing Event from the Standpoint of Mutation Theory of the Target Principle. Albrecht Peiper. Ärzt. Forsch. 4, 116-35(1950) Mar. (in German).

This is a review of the primary events producing cancer and taking place, presumably, in the cell nuclei. 144 literature references.

5102 Discussion on Population Genetics and Radiation. Sewall Wright. J. Cellular Comp. Physiol. 35, Suppl. 1, 187-205(1950) June.

A strong possibility exists that cumulative doses of the order of 300 r may have important effects on the offspring and descendants of those affected and that doses as small as 30 r may not be negligible. There is little or no threat to the persistence of a population as a whole from the cause.

However, there are such enormous gaps in the knowledge of the subject that no judgments of the genetic consequences of radiation in man can be taken very seriously. 16 references. (auth)

5103 Distributed Beta Sources in Uniformly Absorbing Media. I. Harald H. Rossi and R. Hobart Ellis. Nucleonics 7, No. 1, 18-25(1950) July.

Values of dose and flux may be estimated if a beta-emitting isotope is uniformly distributed in a limited region of a biological medium, and if such a "distributed source" has one of a number of simple geometric shapes. In this introduction to the subject, theoretical consideration is given to doses and flux received from point sources, half spaces, slabs, planes, and spheres. The concluding portion of this article, Part II, in Nucleonics (1950) Aug. will be devoted to practical applications of the method.

5104 Dosage Calculation with Radio-iodine. Technical Communication No. 36. T. H. Oddie. Commonwealth X-Ray and Radium Laboratory, Australia, Jan. 1950. 10p. (AEC File No. NP-1585.)

Radiation dosage in tissue resulting from a uniform distribution of I^{131} is calculated for a cylindrical and spherical mass of tissue. 10 references.

5105 Effects of Radiation on Fungi. E. L. Tatum. J. Cellular Comp. Physiol. 35, Suppl. 1, 119-31(1950) June.

The evidence so far suggests that in Neurospora, sensitivity to mutation is dependent on the inherent properties of the gene rather than on the nature of the mutagen, although specific action of particular mutagens will remain as a possible cause of certain infrequent mutant types until more adequate data are obtained. The results of mutational treatment of microconidia indicate that in Neurospora, the extranuclear determination of biochemical characters is rare, if not absent. This supports the current views on the over-all rarity of cytoplasmically inherited characters. At present hopes for specific mutagenic activity seem poor, and what evidence there is seems to point only to the possibility of quantitative, rather than qualitative specificity in mutagenic activity of different agents in different organisms. It would seem theoretically possible that genes may similarly differ in susceptibility to particular agents, and the discovery of mutagens with a high degree of genic specificity seems hopeful. 11 references. (auth)

5106 The Effect of X-rays on Chromosome Structure. Karl Sax. J. Cellular Comp. Physiol. 35, Suppl. 1, 71-81(1950) June.

Chromosomal breaks in the Tradescantia caused by x-radiation and the union of broken ends are described. Breaks induced during the resting stage produce chromosome aberrations, while those induced during prophase produce chromatid aberrations. The relation between x-ray dosage and aberration frequency depends upon the stage of nuclear development and the type of aberration involved. The intensity of the dosage is also considered. The effect of temperature and infrared and ultraviolet radiation during x-ray exposure is discussed. Comparison is made with the effects of neutron radiation.

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5107 Effect of X-rays on Pregnancy and of Pregnancy on Cancer (in Connection with a Personal Case). G. Pinsonneault. L'Union Méd. Can. 8, 945-9(1949).

A 35-year-old woman with mammary cancer became pregnant. The pregnancy progressed normally in spite of a 4,790 r dose of x-rays to the ovaries, administered in a period of three weeks (between 90th and 112th day of the pregnancy). The quality of the radiation used was such that the fraction of the incident dose reaching the fetus could be estimated at more than 30%. When the child was 13 months old it still showed no signs whatever of anomalous development. The mother, who had menstruated regularly before the pregnancy, had had no menstruation since then. The ovarian castration performed at the beginning of the fourth month of pregnancy, and the dose of 1.624 r administered on the mamma during the second month, seemed to have been without any effect on lactation. It did not appear that the development of the mammary cancer had been accelerated by the pregnancy, and the radio-sensitivity of the mammary gland appeared to have been increased as a result of the pregnancy.

5108 Hematopoietic Reactions Following Remote Irradiation of Rabbits. H. Betz and J. Lecomte. Compt. rend. soc. biol. 144, 303-5(1950) Feb. (in French).

The rear paws of 12 rabbits were exposed to 2000 r, the remainder of the body being protected by a lead shield. The animals were sacrificed from 3 hr to 14 days following irradiation. Blood and histologic (spleen, cervical ganglious, bone marrow) changes are described.

5109 Inactivation of Enzyme-Substrate Film by Small Doses of X-rays. Daniel Mazia and Gertrude Blumenthal. J. Cellular Comp. Physiol. 35, Suppl. 1, 171-86(1950) June. (See also NSA 1-741.)

It has been shown that one may, using an enzyme-substrate film, set up in a biochemical system which has a sufficiently high sensitivity to radiation to permit comparisons with more complex biological systems and which is adapted to the study of some of the variables, particularly structural variables, with which radiation biologists are concerned. The radiation sensitivity of the system depends on its structure and may be varied by physical manipulation so that some of the factors involved in intrinsic sensitivity may be investigated. The evidence that the high radiation sensitivity of this system may depend on an intermolecular spreading, over considerable distances, of the effects of a single primary radiation event is discussed. (auth)

5110 Radiation Induced Mutations in Chemical Requirements in Salmonella Typhimurium. Harold H. Plough. J. Cellular Comp. Physiol. 35, Suppl. 1, 141-55(1950) June.

Attention is directed to the desirability of pathogenic bacteria of the genus Salmonella as objects of genetic study using radiation as a mutagenic agent. Isolation methods are described and four different classes of mutations, isolated and investigated in Salmonella, are depicted. At least one other class, i.e., antigenic variants, is also indicated. Differences in the spontaneous frequency of these classes of mutations are suggested by the relative numbers isolated from irradiated lines. 16 references. (auth)

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5111 Some Present Problems in the Genetic Effects of Radiation. H. J. Muller. J. Cellular Comp. Physiol. 35, Suppl. 1, 9-70(1950) June.

The frequency of the primary genetic effects of ionizing radiation, gene mutations and chromosome breaks, is proportional to that of the ionizations produced, and, within wide limits, it is independent of wavelength, and of the time-intensity distribution of treatment. It is not, however, independent of the genetic and environmental conditions accompanying treatment. Since gross arrangements of chromosome parts require two or more chromosome breaks, which in the case of x and γ rays are usually independent, their frequency follows a higher power of the dose than one. In Drosophila, but probably relatively little in most organisms other than Diptera, these rearrangements are accompanied by changes in the functioning of genes, often including lethal effects, near the sites of breakage. The question is considered why the frequency of lethals appears to remain proportional to dose even at high doses, despite the existence at such doses of a considerable class of lethals caused by the position effect of rearrangements whose increase in frequency follows a higher power of the dose than one. It is pointed out that this is probably because the rise in lethal frequency which would be caused in this way is at least partly compensated for by the presence of another kind of lethals, due to small rearrangements, especially deficiencies, which as the dose rose would increasingly come into combination with gross rearrangements and so become in part irrecoverable and in part lost to view as separate lethals. Not enough is yet known about the preferences of broken chromosome ends for one rather than another type of union to permit reliable calculations to be made of the expectations for different types of lethals at high doses, where there is much competition for union. Examples of some of the as yet unsolved problems concerning the manner of origination of chromosome changes are given together with some new evidence concerning them. It is shown that a high proportion of induced small deficiencies must result from two breaks in the same chromosome or chromatid, followed by deletion of the interstitial piece rather than by exchange of unequal segments between sister chromatids. Evidence of the high frequency of cases of restitution is presented, based on data from ring chromosomes, but the total frequency of restitutions is still unknown. Grounds are given for concluding that the distinction between chromosome structural changes, even small ones and gene mutations, is valid, despite the fact that these processes are in some ways related. Some problems are considered concerning the amount and the mode of manifestation of radiation damage to the genetic material of the somatic cells of an exposed individual. 128 references. (auth)

5112 Sulfhydryl-containing Agents and the Effects of Ionizing Radiations. I. Beneficial Effect of Glutathione Injection on X-ray Induced Mortality Rate and Weight Loss in Mice. W. H. Chapman, C. R. Sipe, D. C. Eltzholtz, E. P. Cronkite, and F. W. Chambers. AEC File No. NP-1365, Sept. 1, 1949. 13p.

Male and female mice were exposed to 800 r of total body x-ray radiation. Four hundred were given glutathione before or both before and after irradiation. Two hundred were given control saline injections and 200 were given no treatment. The survival rates of the glutathione-treated groups were greater (63.8%) than the survival rates for the comparable

control groups (40 to 46%). Statistical analysis showed that the differences in survival rates were definitely significant. The surviving glutathione-treated irradiated animals lost less weight and recovered weight more rapidly than the surviving irradiated control animals. Glutathione-treated survivors, when traumatized, had a lower mortality than the nontreated controls. 34 references. (auth)

5113 The Economic Integration of Radiological Safety into the Industrial Safety Program. Julius Hannoch. AECU-850, Mar. 29, 1950. 19p.

This paper given at the 20th annual safety convention and exposition of the Greater New York Safety Council, discusses background for the problem, industrial application of radioisotopes, permissible dose, and radiomaterials and the safety program.

5114 Some Public Health Aspects of an Atomic Explosion. William H. Sullivan. Naval Radiological Defense Laboratory Report No. AD-223(L), June 3, 1950. 14p.

This lecture was delivered at the Basic Training Course for Physicians on the Medical Aspects of Atomic Warfare at Birmingham, Alabama, May 5, 1950. In summary, the primary problem of concern to the public health officials at the present time is that of education. Well defined operational plans must be implemented to make the best use of the available physicians and their corps of assistants. Also, studies must be made of the various other facets of public health relief, such as inadequate supplies of potable water and food, the bacteriological problems, and the toxicological problems, which are secondary to the immediate effects but nevertheless potential destroyers of life. There must be more training courses to give all physicians who might be called upon, sound, practical, down-to-earth information, which will enable them to handle the casualties with more than a smattering of ignorance concerning radiation damage effects.

5115 Biological, Medical, and Health Effects and Implications of Atomic Energy in New York City; Eighth Exploratory Meeting Held at the Academy of Medicine, New York City, by Religious and Welfare Committee. New York Committee on Atomic Information, Inc., Apr. 26, 1949. 34p. (AEC File No. NP-1427.)

5116 The Burn Problem in Atomic Warfare. Everett Idris Evans. J. Am. Med. Assoc. 143, 1143-6(1950) July 29.

The large number of thermal burn casualties expected as a result of an atomic bomb blast is emphasized. Advance emergency measures and methods of treatment of burns are discussed. The author considers it imperative that a search for a safe, effective, easily stored plasma substitute be started immediately.

5117 The Hazards of Radiation. P. C. Koller. Discovery 10, 241-9(1949) Aug.

A brief survey is presented on the biological effects of radiation. Chromosomal damage and pathological changes due to radiation are discussed.

5118 The Medical Aspects of Atomic Weapons. Irwin M. Pochapin. Pennsylvania Med. J. 53, 703-7(1950) July.

The types of injuries due to an atomic bomb blast are described with emphases placed on the casualties due to exposure to the nuclear radiation. First aid and hospital care and the selection of casualties for treatment based on the nature and extension of their injuries are discussed.

5119 Medical Aspects of Atomic Weapons. Washington, National Security Resources Board, 1950. 24p.

This is one of a series of reports which assess, in general terms, what is known about the results of an atomic explosion, what damage and injuries a bomb can cause, and what can feasibly be done to protect people and structures. This first report deals particularly with the effects of an atomic bomb explosion upon people within its range, the medical and biological aspects of injuries and their treatment. This and the other related reports are being prepared at the request of the National Security Resources Board, which has been charged by the President with responsibility for coordinating plans concerned with civilian defense in event of war. The material is based on a wide variety of investigations, discussions, and documents brought together by experts in the various fields. Later reports will deal with (a) the damage caused by the air-blast created by an atomic explosion, how buildings can be constructed to resist these effects, and (b) how contamination can be detected and measured.

5120 Radiobiological Research. J. J. Jaklitsch, Jr. Mech. Eng. 72, 17-8(1950) Jan.

This article reports the study of the long-term effects of atomic bomb radiation at Bikini. Radioactivity is declining but still is detectable throughout the coral reef that circles the lagoon. External radiation is not dangerous except, perhaps at the bottom of the lagoon some 200 ft under the surface. Enough radioactive material probably exists to be ultimately dangerous to rats, crabs, and fish if they take the substance into their bodies, or to men if they were to eat for some time the fish from the lagoon or the coconuts from the island's palm trees.

5121 Atomic Energy in Clinical Medicine. III. The Benefits of Atomic Energy. Ars Med. 5, 469-507(1950) June. (in French) (See also NSA 4-4142.)

This is the last of a series of articles reviewing the biological and medical aspects of atomic energy and radioisotopes. This paper discusses the use of radioisotopes as tracers in the study of blood, proteins, lipids, and nucleic acids, and its use in diagnosis and location of brain tumors, its application to cancer research and treatment for cancer, and finally, its application to the study of plant growth and use in plant fertilizer to enhance the value of the fertilizer.

5122 Investigation of Thyroid Function and Disease with Radioactive Iodine. E. E. Pochin. Lancet 259, 41-6, 84-91(1950) July 8 and July 15.

The circulation of iodine through the body may be examined quantitatively using radioactive iodine, and the duration of various stages of the iodine cycle compared in Graves's disease and in health. Normally, iodide injected intravenously is distributed within 2 hr through 40% of the bodyweight, from where it is removed by thyroid or kidneys after a mean time of 6 to 8 hr. It then remains for many weeks in the thyroid, and for a few days as circulating

thyroxine before re-entering the cycle or being excreted by the kidney. In Graves's disease the mean stay as iodide is 1 to 2 hr; that in the thyroid averages 5 days and may be less than 1 day; and 2 days are spent in circulation as thyroxine. Most of the iodine liberated from the tissues probably re-enters this cycle. The thyroid's avidity for iodide may be measured by the rate at which it clears plasma of radioiodide. In Graves's disease this thyroid clearance rate is usually raised from a normal average of 25 ml/min to more than 100 ml/min. Iodine is at first found to be concentrated in the thyroid, in the bladder and kidneys, and in gastric and salivary secretions. In thyrotoxic patients, after a few days some localization may occur in the liver area, presumably from thyroxine concentration. The distribution of radio-iodine may indicate whether a thyroid carcinoma itself concentrates iodine or replaces iodine-concentrating thyroid tissue. 22 references. (auth)

5123 Multiple Myeloma: A Study of 24 Patients Treated with Radioactive Isotopes (P^{32} and Sr^{89}). John H. Lawrence and Louis R. Wasserman. Ann. Internal Med. 33, 41-55(1950) June.

Radioactive phosphorus and radioactive strontium have been used as therapeutic agents in multiple myeloma. Improvement was noted in some cases. The average length of life after the onset of the disease in this group of patients was approximately 3 years. These isotopes are valuable in producing whole body background irradiation which may in itself afford some relief. The combination of isotope therapy and x-ray or stilbamidine or urethane is suggested. 16 references. (auth)

5124 The Present Status on the Radiotherapy of Tumors. Pierluigi Barbieri. Radiologia 6, 1-19(1950) Jan.-Feb. (in Italian).

The author examines the latest concepts in the field of radiobiology relative to tumor growth and the modern therapeutic methods which the radiotherapist has obtained from physics. The advantages, indications, and results obtained up to the present time using high voltages (betatron), neutron therapy, and radioisotopes are analyzed. 29 references. (auth)

5125 Roentgenotherapy of Bronchial Asthma. H. J. Eichhorn. Med. Klin. (Munich) 45, 230-3(1950) (in German).

An historical sketch of the problem of the pathogenesis of bronchial asthma, as related to the attempts (begun in 1906) at a radiological cure of the disease, precedes an account of the author's own work. The aim of his technique is to affect the allergic condition, reflected in the vagotonia, blood eosinophilia, and increased specific-antibody content, by irradiating the paravertebral and peripheral ganglia, the postgangliar fibers, and the periarterial and terminal network of the skin. A spleen irradiation, producing a desensitizing effect, accompanies the main treatment. Breathing gymnastics is considered an important element of the method. Dosages were as follows: 150 surface r on the hilus, alternately from chest and from back, filtered 2 mm Al to 0.3 mm Cu, in four irradiations alternating with four-day long interruptions; the spleen is irradiated in two fields with 150 r each, the irradiations being delivered midway and at the end of the main treatment. The results are 25% cured and 50 to 65% showing transitory improvement.

5126 The Significance of Radioisotopes to Radiology. J. W. J. Carpender. Wisconsin Med. J. 49, 489-92 (1950) June.

Some of the more important radioisotopes are discussed in this paper in relation to radiology. Two cases are presented in which P^{32} was successfully used in the treatment of chronic leukemia and polycythemia vera. The characteristics, applications, and dosimetry of I^{131} are described and discussed; radiosodium, radioarsenic, radiomanganese and radiogold (for the treatment of hematopoietic diseases) and radiocobalt (as a substitute for radium) are also included in the discussion. Mention is made of the use of a large number of radioisotopes in tracer experiments.

5127 Treatment of Hyperthyroidism. George Crile, Jr. Surg. Gynecol. Obstet. 91, 242-4(1950) Aug. (Editorial).

The use of radioactive iodine (I^{131}) as one of the methods of treating hyperthyroidism is pointed out. It is considered satisfactory except in cases of nodular goiter with hyperthyroidism.

5128 Treatment of Thyrotoxicosis with Radioactive Iodine. Edgar S. Gordon and Edwin C. Albright. J. Am. Med. Assoc. 143, 1129-32(1950) July 29.

One hundred and twenty cases of hyperthyroidism treated with radioactive iodine and followed for 5 to 33 months are reported. All patients responded to therapy, and all have returned to euthyroid status except 3 who have become hypothyroid and several patients who recently began but have not yet completed therapy. Both nodular and diffuse goiters have been treated and no consistent difference has been noted in the rate or mode of response. Untoward reactions to radioactive iodine have not been seen. The clinical problems involved in radioiodine therapy are discussed, including those of dosage and variation in sensitivity to radiation. The authors consider use of radioactive iodine the treatment of choice for toxic goiter, excepting only goiters during pregnancy, large goiters producing mechanical obstruction and very hard glands involving the danger of malignancy. (auth)

5129 Use of Pressure in Plesiotherapy of Cavernous Angioma. Bruno Uggeri. Radioterap. radiobiol. e fis. med. 2, 259-68(1949)(in Italian).

By exercising pressure upon the tumor during the irradiation, the author obtained very satisfactory results in a number of cases of cavernous angioma of skin and urethra, which were treated by plesioroentgenotherapy. The pressure reduces the depth of the tumor, thus permitting an even distribution of ray action; it also forces the blood out of the cavernous tissue, thus facilitating the irradiation of the latter. A thin wooden hemisphere, attached to the funnel of the tube, is used for applying the pressure. Five cases are described in detail. The best results are obtained with children.

5130 Retention of Beryllium in Animal Tissues Following Inhalation of Its Salts. H. E. Stokinger, L. T. Steadman, and R. E. Root. AECU-851, Apr. 25-27, 1950. 2p.

The document is in abstract form; it is reproduced below in its entirety.

Data on beryllium deposition have been obtained by spectrographic analysis of tissues of animals following inhalation of beryllium salts as dusts and mists. This information is

basic to a better understanding of the action of beryllium in the body. Data from five animal species are offered regarding: (1) distribution in the body, (2) accumulation and retention, (3) elimination and biologic half-time in lung, and (4) effect of atmospheric concentration and dietary restriction on distribution.

Deposition was confined chiefly to five sites in the animal body — lungs, pulmonary lymph nodes, bone, liver, and kidney, in order of decreasing magnitude. On the basis of total organ content, the skeleton retained the bulk of the beryllium in the body (50 to 80%) if the inhaled aerosols were soluble compounds, such as $BeSO_4$ and BeF_2; the lungs retained the bulk of the Be if the compounds were insoluble, such as BeO. Per unit tissue weight, the lungs retained the highest beryllium content irrespective of the solubility of the aerosol.

At low exposure concentrations to soluble beryllium salts, 1 mg/m³ or less, accumulation in the lungs rarely attained 10 μg/g of fresh tissue despite continued daily exposure for several months. Bone beryllium values ranged from ⅓ to ⅒ that of the lungs. Beryllium values of the liver and kidneys amounted to but fractions of these values.

On the other hand, in the lungs of animals exposed to the insoluble BeO, fractions of milligrams to milligrams per gram of lung often accounted for more than 99% of the beryllium stored in the body.

Accumulation of beryllium in the lungs has been found to progress linearly with time over relatively long periods in at least two species (rat and rabbit) despite low exposure concentrations and high water solubility of the aerosol. Elimination from the lungs, however, differed markedly among species, the half biologic-retention time (BR_{50}) for the rabbit being 23 days whereas that for the hamsters was calculated to be of the order of 112 days, a fivefold difference. Because this difference in elimination was found to correlate with the toxic response of a number of species, it is suggested that this capacity to eliminate beryllium may determine in some degree the susceptibility of species to beryllium. No experiments of sufficient duration have yet been made to determine the BR_{50} of bone; it would appear to be greater than one year.

It was found that the distribution of inhaled, soluble beryllium salts differed strikingly depending upon the concentration to which the animals were exposed. At 10 mg/m³, 25 to 45% of that in the lung resided in the reticuloendothelial tissues; at 1 mg/m³, 1%. Thus the mode of transport in the body appears to differ according to the amount of beryllium inhaled.

Moreover, it was discovered that the rate of elimination of beryllium from the body could be influenced by modification of dietary intake. Rats on a diet restricted to half normal intake eliminated 35% of the beryllium stored in the body in a five-week period as against 17% in a similar rat group on an unrestricted intake. In the former group, the greatest contribution to the increased elimination appeared to come from the lung.

5131 Acute Toxicity of Inhaled Beryllium. III. Observations Correlating Toxicity with the Physiochemical Properties of Beryllium Oxide Dust. R. H. Hall, J. K. Scott, S. Laskin, C. A. Stroud, and H. E. Stokinger. Arch. Ind. Hyg. Occupational Med. 2, 25-48(1950) July.

Acute pneumonitis closely resembling the corresponding disease of beryllium industrial workers has been observed in laboratory animals which were experimentally exposed to beryllium oxide dust for short periods (subchronic poisoning). The relative toxicities of four grades of beryllium oxide were compared in experiments in which a total of 133 animals of 6 species were used. The four grades of beryllium differed in certain physico-chemical properties, notably in ultimate particle size and state of aggregation, that were referable to differences in the kinds of beryllium compounds from which they were produced by calcination and in the temperature and duration of firing. Injury to the lungs and histologic and pathologic studies are described. At present the most reliable clinical index of beryllium poisoning observed in these studies has been the development of hematologic changes resembling macrocytic anemia, possibly hypoplastic or aplastic in nature. Spectrographic analyses of tissue samples revealed that only a very small fraction of the beryllium that was inhaled and retained was distributed in tissues of the body other than the lungs and pulmonary lymph nodes. The evidence indicates that inhaled beryllium oxide dust is removed from the site at which it is deposited in the lungs almost exclusively by phagocytosis. Effects on the exposed animals other than lung damage are noted. 19 references.

5132 Body Radium Content of Individuals with No Known Occupational Exposure. John B. Hursh and Allan A. Gates. Nucleonics 7, No. 1, 46-59(1950) July.

The radium content of the body of 25 adult individuals with no known occupational exposure to radium has been measured. The average value is believed to be 1.18×10^{-10} g radium per whole body. This agrees qualitatively with predictions based on the radium content of the water supply and known constants for radium metabolism by the body. The radium content of the body, as derived from measurements reported in this paper, is about ⅟₁₀₀ as great as analogous figures previously existing in the literature and about ⅟₃₀,₀₀₀ of the radium content known to produce neoplastic bone changes. It is, therefore, concluded that to the extent to which the present measurements are representative, it is unlikely that irradiation of the bone by body-radium will be an important factor in the production of osteogenic sarcoma in individuals not occupationally exposed to radium. (auth)

5133 Dissociation Constants of Radium-Organic Acid Complexes Measured by Ion Exchange. Jack Schubert, Edwin R. Russell, and Lawrence S. Myers, Jr. J. Biol. Chem. 185, 387-98(1950) July.

A modified formulation of the equations used to calculate the dissociation constants by the equilibrium ion exchange method is presented. The dissociation constants of the complexes formed between radium and several acids (in isotonic neutral media) were measured. The complexes are of the 1:1 type. At 25° the stability of the radium complex ions is in the order citric > sulfosalicylic > oxalacetic > fumaric > tartaric > succinic > pyruvic > aspartic. Between 7 and 37° no appreciable change in the dissociation of radium citrate is found. A preliminary discussion is given of factors involved in the formation of complex ions. It is postulated that the protons in the hydration sheath surrounding the cation tend to form linkages with those anions that are hydrogen acceptors. Some relations of complex formation to metabolic and biochemical phenomena are also considered. 21 references. (auth)

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5134 The Importance of Fluoride Elements in the Pathogenesis of Lung Disorders Produced by Beryllium Compound Dusts. A. Policard. Bull. acad. natl. med. 134, 289-90(1950) Apr. 25 (in French).

The author believes that the toxic effects of industrial beryllium compounds, in particular beryllia, are not entirely due to the beryllium, but to the sodium fluoride which is found in beryllia up to a proportion of about 5%.

5135 Prophylaxis and Treatment of Persons Exposed to Dangers of Intoxications. A. Jordi. Ärzt. Monat. 5, 159-76(1949).

Prophylaxis should be extended to the selection of workers, administration of antidotes, frequent examinations during exposure, temporary change of employment, and, if necessary, definite exclusion. The curative effect of antidotes is contested generally. The points mentioned are discussed in regard to intoxications with lead, mercury, dinitrobenzene, benzene, aniline, tar, radioactive substances, perchlornaphthalin, carbon disulfide, yellow phosphorus, and silicon compounds.

5136 The Improvement of Soil Management and Crop Production through Investigations with Isotopes. U. S. Department of Agriculture. AECU-855, Feb. 1950. 18p.

The progress through 1949 of a program of research with the following objectives is reported: (1) research on procedures for the use of isotopes in this subject-matter field; (2) fundamental investigations in soil chemistry and plant biochemistry and nutrition; (3) the general application of isotopic procedures to problems of soil management, fertilization, and crop production; (4) provision of adequate facilities for the production of radioactive fertilizers, soil amendments, and related materials; (5) provision for training qualified scientists on the use of isotopes in soil and plant research. Appendix A gives experimental results and procedures on preparation of fused tricalcium phosphate containing P^{32}. Appendix B summarized the scope and general nature of radioactive phosphorus field experiments to be conducted in 1950.

5137 Metabolic Exchange of Carbon Dioxide with Carboxyls and Oxidative Synthesis of C_4 Dicarboxylic Acids. J. W. Foster and S. F. Carson. ORNL-615, June 13, 1950. 20p.

Biosynthesis of fumaric acid by a $2C_3$ condensation in the mold Rhizopus nigricans has been confirmed and extended. It has been demonstrated that CO_2 can undergo metabolic exchange with carboxyls of preformed fumaric acid. According to these experiments demonstration in normal tissues of the Wood-Werkman formation of C_4 dicarboxylic acids by locating the labeled CO_2 in carboxyls of these acids would not constitute unequivocal proof of net synthesis involving carbon dioxide. Evidence has been obtained for the probable operation of a C_4 dicarboxylic acid respiratory cycle in this mold. 15 references. (auth)

5138 The Utilization of the Branched Chain of Isobutyric Acid Studied with C^{14}. Irving Gray, Patricia Adams, and Heinrich Hauptmann. URCL-749, June 9, 1950. 12p.

A mechanism for the breakdown of isobutyric acid in rats is proposed based on the fate of the methyl groups of the branched chain traced by means of the compound labeled in the carboxyl group and methyl groups with C^{14}. 17 references. (auth)

5139 Biochemical Stability of the Methyl Group of Creatine and Creatinine. Cosmo G. MacKenzie and Vincent Du Vigneaud. J. Biol. Chem. 185, 185-9 (1950) July.

Creatine and creatinine labeled with C^{14} in the methyl group have been synthesized and administered to rats in single oral or parenteral doses of 1.1 to 1.4 g/kg of body weight. The expired carbon dioxide collected during the next 1 or 2 days contained little or none of the labeled carbon. It may be concluded therefore that, under the experimental conditions employed, the methyl group of creatine and creatinine is not oxidized to an appreciable extent by the intact rat. In this respect creatine and creatinine differ from the other methyl compounds so far investigated. The excretion of C^{14} in the urine and feces following the administration of radiocreatine or radiocreatinine is reported. 15 references. (auth)

5140 The Conversion of N^{15}-Containing Indole to Niacin by Niacin-Requiring Strain 39401 of Neurospora. David M. Bonner and Elga Wasserman. J. Biol. Chem. 185, 69-74(1950) July.

A mutant strain of Neurospora 39401 is known to require niacin for growth and to be able to utilize 3-hydroxyanthranilic acid, kynurenine, tryptophan, or indole in place of niacin. As a direct check of the conversion of indole to niacin by this strain, it was grown on indole containing 18.6 at. % excess N^{15}. The niacin present in the formed mycelium was isolated and analyzed for its N^{15} content, which was found to be 4.7 at. % excess. The implications of the discrepancy between the observed value of excess N^{15} present in the isolated niacin and the predicted value of 18.6 at. % excess are discussed. 18 references. (auth)

5141 Development of a Dispenser for Applying Radioactive Phosphatic Fertilizer. Glenn A. Cumings, Walter C. Hulburt, and Dale B. Eldredge. Agr. Eng. 31, 275-7 (1950) June.

A description is presented concerning a special dispenser constructed for the safe application of radioactive phosphate fertilizer and meeting the following requirements: the hopper was to be self-cleaning and completely empty at the end of each run; the workers were to be safely shielded from the radioactive phosphate in the hopper by any material equal in weight to ⅛ in. Al; there were to be no rough or porous surfaces, pockets, ledges, or obstructions where the phosphate might accumulate; the hopper was to be easily accessible for easy cleaning and decontamination; furrow openers were to be designed to reduce clogging to a minimum; visibility through transparent shielding was essential at various points; and adequate enclosure of the entire system was necessary to prevent the escape into the air of excessive amounts of radioactive fertilizer dust. The dispenser consists essentially of a stationary enclosed hopper box with an endless-belt bottom. Longitudinal floating panels serve as the sides of the box and as partitions for dividing the hopper into two or more compartments; spouts with dividers under the panels collect and channel the fertilizer into the delivery tubes. The particular method of depositing a calculated amount of the radioactive fertilizer and a number of provisions to

guard against undue wear of the machine are discussed under separate headings.

5142 The Effect of Adrenocorticotrophic Hormone and Surgical Operations on Iodine Excretion. J. P. Gemmell, and W. F. Perry. Can. J. Research 28E, 147-51(1950) Aug.

Further investigations have been carried out on the previously reported (W. F. Perry and J. P. Gemmell, Can. J. Research 27E, 320 (1949)) increase in iodine excretion which occurs following the stress of surgical operations. By means of adrenocorticotrophic hormone it was demonstrated in 4 subjects that increased activity of the adrenal cortex does not of itself cause an increase in iodine excretion. In 6 patients subjected to elective surgical procedures it was shown with the aid of radioactive iodine that the inorganic iodide of the body tissues is not the source of increased iodine excretion which follows such operations. Other possible causes and sources of the postoperative increase in iodine excretion are discussed. (auth)

5143 The Effect of Phytate and Other Food Factors on Iron Absorption. Leon M. Sharpe, Wendell C. Peacock, Richard Cooke, and Robert S. Harris. J. Nutrition 41, 433-45(1950) July 10.

The effect of 7 test meals upon the absorption of either reduced Fe^{55} or reduced Fe^{59} fed to adolescent boys was measured. The test meals consisted of (I, VI) milk, rolled oats, tomato juice, white bread, and omelet; (II) milk; (III) milk and sodium phytate; (IV, VII) milk and rolled oats; and (V) water. Each meal contained approximately the same amount of iron. Meals I, VI, and VII contained the same level of natural phytate in rolled oats; meal III contained the same quantity of phytate, as the sodium salt; meal IV contained approximately half as much rolled oats and phytate as meal VII: phytate was absent from meals II and V. The following percentages of radioactive iron were absorbed from these meals: (I) 4.43, (II) 17.4, (III) 1.74, (IV) 9.81, (V) 26.9, (VI) 5.76, and (VII) 8.84. Milk reduced the absorption of iron by one-third. This was not due to the action of phytates, as the milk contained none. Rolled oats and milk reduced the absorption of iron by two-thirds. Thus, rolled oats interfered no more than did milk. There was no correlation between the phytate content of rolled oats and the reduction in iron absorption. Sodium phytate reduced the absorption of iron by 15-fold, indicating that added soluble phytates can interfere with iron absorption. The absorption of iron from the breakfast was one-fifth that from the water meal. Medicinal iron should be more effective if administered between meals. Evidence is presented for the inverse correlation of iron absorption with the solids content of the test meals. 18 references. (auth)

5144 Effect of Vitamin B_{12} on the Phosphorus Metabolism of Lactobacillus Leichmannii. Irena Z. Roberts, Richard B. Roberts, and P. H. Abelson. J. Bact. 58, 709-10(1949).

The results of experiments on the uptake of radioactive P^{32} by Lactobacillus leichmannii in the absence and in the presence of vitamin B_{12} are presented. It was found that B_{12} increased the amount of the P^{32} incorporated by the bacillus in the total cell, the acid-soluble fraction and the desoxyribosenucleic acid fraction; the effect was most pronounced in the desoxyribosenucleic acid fraction. These observations are considered to be in accord with the concept that vitamin B_{12} is involved in nucleic acid synthesis.

5145 Factors Determining the Rate of Renal Excretion of Iodine. I. The Thyroid. William H. Beierwaltes, Robert A. Peelor, Isadore Lampe, and Henry J. Gomberg. Univ. Hosp. Bull., Univ. Michigan 14, 31-3(1948) Apr.

Patients having large variations in thyroid activity were given 100 mc of I^{131} by mouth without carrier in a glass of water. The curves obtained in patients with hypo- and hyperthyroidism, showing that ranges with a factor as great as 140 in the thyroid uptake may be accompanied by relatively small variations in the rate of urinary excretion, suggest the influence of extrathyroidal factors on urinary excretion of iodine. Great variations of total iodine excretion in 24 hr. and 5-day periods encountered in normal thyroid activity again indicate the possibility that extrathyroidal factors might greatly affect the rate of excretion. Probably the most important extrathyroidal factor is the plasma level of iodine, as shown by the studies of Nelson et al (J. Clin. Invest. 26, 301 (1947)). The plasma level of iodine exhibits its greatest fall during the first 24 hr after administration of an oral dose of iodine. This, significantly, duplicates the curves shown on the rate of urinary iodine excretion in various thyroid states.

5146 The Formation of Ketone Bodies From Isovaleric Acid. Irving Zabin and Konrad Bloch. J. Biol. Chem. 185, 117-29(1950) July.

The preparation of 4,4′-C^{13}-isovaleric acid is described. Rat liver slices were incubated in the presence of a mixture of 4,4′-C^{13}-isovaleric acid and 1-C^{14}-isovaleric acid. The resulting ketone bodies were isolated and their isotope concentrations determined. Evidence has been obtained to show that isovaleric acid is oxidized initially at the β-carbon atom to yield a 3-carbon and a 2-carbon intermediate and that both intermediates are metanolized further to yield acetoacetate. The isopropyl portion of isovalerate is more rapidly converted to ketone bodies and less rapidly oxidized to CO_2 than the carboxyl half. 24 references. (auth)

5147 Further Observations on the Absorption and Translocation of Inorganic Solutes Using Radioactive Isotopes with Plants. T. C. Broyer. Plant Physiol. 25, 367-76(1950) July.

With the use of abscised barley roots immersed in radioactive bromide solutions, it has been possible to more closely delimit the modes of migration of electrolyte into tissues at low and high temperatures as well as into systems of previously high- or low-salt content. This study suggests several points. First, there is a rapid exchange of isotopes between the external medium and roots; second, under favorable temperature conditions isotopic or ion exchange is relatively less important than migration by metabolic accumulation; third, that with high-salt roots at low temperature, migration may be restricted almost exclusively to adsorption exchange; and fourth, that metabolic accumulation may be pronounced even with roots at low temperature, provided they are currently in a relatively low-salt condition. With the use of decapitated barley plants and isotopes of bromide it has been shown that 2 pathways are afforded for the migration of inorganic solutes into roots. First, with low salt plants, salt may migrate across the cytoplasm of cells into vacuoles as well as to more remote lumena, e.g., the xylem. Second, where the

roots are initially in a relatively high salt condition, subsequent migration takes place differentially along continuous protoplasmic paths (the symplast) to the xylem, circumventing, in a measure, movement into or through intervening vacuoles. Where depletion of vacuolar solute occurs through translocation, the probable pathway is likewise along the protoplasmic continuum. 12 references. (auth)

5148 Influence of the Adrenal Cortex on Body Water Distribution and Renal Function. Mario Gaudino and Marvin F. Levitt. J. Clin. Invest. 28, 1487-97(1949) Nov.

Simultaneous measurements of extracellular fluid volume (inulin space), total body water (D_2O space), intracellular fluid volume (by calculation), Na^{24} and K^{42} volumes, plasma volume, thiocyanate space, and renal function (C_{In}, C_{PAH}, Tm_{PAH}), were made in dogs during treatment with desoxycorticosterone acetate (DCA), adrenal cortical extract and during progressive adrenal insufficiency. DCA caused a decrease in intracellular fluid volume and an expansion of the extracellular space. C_{In} and C_{PAH} increased during therapy while Tm_{PAH} decreased. The intracellular concentrations of sodium and potassium were both elevated at the peak of response to therapy. Cortical extract caused an increase in intracellular fluid volume with no alteration in the extracellular space. No consistent influence on renal function was observed during extract treatment. During adrenal insufficiency, the intracellular volume increased while the extracellular space decreased. C_{In}, C_{PAH}, Tm_{PAH} decreased. The relative constancy of the plasma volume as compared to much greater variations in the extracellular space indicates that plasma volume is not a sensitive index of alterations in the latter. Thiocyanate space does not follow the extracellular space as measured by inulin. The effects of DCA and cortical extract in the intact animal are transient, all physiological variations observed tending to return toward normal despite continued treatment. 56 references. (auth)

5149 Influence of Thyroid Activity on Exchange of Liver Adenosine Triphosphate Phosphorus. Poonamalle R. Venkataraman, Alamela Venkataraman, Martin P. Schulman, and David M. Greenberg. J. Biol. Chem. 185, 175-83(1950) July.

Labeled phosphate in the form of Na_2HPO_4 was administered intravenously to normal, hyper-, and hypothyroid rats in a postabsorptive state. P^{31} and P^{32} in the acid-soluble phosphorus fractions of the liver and plasma have been determined. The ATP of TCA extract of liver, precipitated together with other mercuric-insoluble nucleotides, has been determined by the use of adenosinetriphosphatase (myosin) prepared from rabbit muscle. While there appears to be no marked variation in the P^{31} values of the acid-soluble fractions of the livers between normal, hyper-, and hypothyroid rats, the differences in P^{32} values are significant. In a short time experiment, the organic binding of P^{32} in liver is mostly due to its incorporation into the terminal group of ATP. The P^{32} concentrations of plasma inorganic phosphate in normal, hyper-, and hypothyroid animals indicate an accelerated transfer of P^{32} from plasma to cell in hyperthyroidism and a retarded transfer in hypothyroidism. The different specific activities of the terminal labile P of ATP in the hyper- and hypothyroid groups may reflect accelerated and retarded oxidations, respectively, within the cell. It has not been possible to decide whether an increased rate of synthesis of ATP occurs or not, since the specific activity of the intracellular inorganic P is not known. 31 references. (auth)

5150 Isotopic Tracers and Nuclear Radiations with Applications to Biology and Medicine. William E. Siri. New York, McGraw-Hill, 1949. 136p. (See also NSA 4-10.)

This book has been developed to bridge the gap between those books intended solely for the nuclear physicist and those which merely describe the results of research in which radioactive isotopes and nuclear radiations were used. To this end, the authors have presented the thoery, the methods of measurement, and the principles of applications of tracers and radiations without stressing unnecessary and complicated features of nuclear physics or rapidly outdated experiments in biology.

5151 The Location in Protoporphyrin of the Carbon Atoms Derived from the α-Carbon Atom of Glycine. Jonathan Wittenberg and David Shemin. J. Biol. Chem. 185, 103-16(1950) July.

Whole duck blood was incubated with glycine labeled with C^{14} in the α-carbon atom. The labeled hemin isolated was degraded in order to locate the positions of the carbon atoms in protoporphyrin which are derived from the α-carbon atom of glycine. The hemin was converted by suitable chemical degradation of methylethylmaleimide (derived from the pyrrole rings A and B of the protoporphyrin) and to hematinic acid (derived from the pyrrole rings C and D of the protoporphyrin). The activities of these two compounds were identical. In methylethylmaleimide only carbon atoms A2 and B2 are active and in hematinic acid only carbon atoms C2 and D2 are active. These active carbon atoms are in comparable positions in pyrrole rings A and B and in C and D. The total activity of these carbon atoms (A2, B2, C2, and D2) accounts for only 50% of the total activity of the porphyrin. The remaining 50% of the activity must reside in the carbon atoms of the methene bridge. Their average activity is equal to that of the active carbon atoms in the pyrrole rings. It is concluded in the discussion that all 4 carbon atoms of the methene bridge are labeled and that they have equal activities. Therefore 8 carbon atoms in protoporphyrin are derived from the α-carbon atom of glycine, and these carbon atoms are located in positions A2, B2, C2, and D2 and in the 4 carbon atoms of the methene bridges. Hypotheses for porphyrin formation are discussed briefly. 24 references. (auth)

5152 The Metabolism of Acetone. I. Gross Aspects of Catabolism and Excretion. T. Duane Price and D. Rittenberg. J. Biol. Chem. 185, 449-59(1950) July.

Small doses (0.1 to 0.6 mg per 100 g of body weight) of acetone labeled with C^{14} in the methyl positions were administered to rats by stomach tube. At the dosage level employed, radioactive carbonyl compounds excreted through the lungs comprised less than 10% of the administered radioactivity. At least half of the activity was oxidized to carbon dioxide and exhaled in the respiratory air within 24 hr. The results show that although acetone is extensively oxidized in the normal intact rat the oxidation is slow compared to that of metabolites on major metabolic paths. An alloxan-diabetic rat was also found capable of oxidizing acetone. Extensive conversion of acetone to acetylating agent was shown. Acetone carbon atoms were found to enter the fol-

lowing compounds arranged in order of decreasing carbon specific activity: urea, liver cholesterol, carcass cholesterol, glutamic acid, heme, liver glycogen, aspartic acid, arginine, and carcass fatty acids. The significance of these conversions is discussed. 27 references. (auth)

5153 On the Origin of the Carbon Chain of Cysteine in the Rat. Jakob A. Stekol, Kathryn Weiss, and Sidney Weiss. J. Biol. Chem. 185, 271-4(1950) July.

Methionine labeled in the methyl carbon with C^{14} and glycine labeled with C^{14} in the amino carbon were administered separately to different rats, together with bromobenzene, and radioactive p-bromophenylmercapturic acid was isolated from the urine. Degradation of the acid revealed the presence of radioactive carbon in the cysteine of the isolated product. Cystine in the hair of the rats which received either radioactive methionine or glycine also was radioactive. The results demonstrate that the methyl group of methionine and the carbons of glycine are utilized by the rat for cysteine synthesis, probably via serine. 11 references. (auth)

5154 On the Role of 2,6-Diaminopurine in the Biosynthesis of Nucleic Acid Guanine. Aaron Bendich, Sidney S. Furst, and George Bosworth Brown. J. Biol. Chem. 185, 423-33(1950) July.

2,6-Diaminopurine has been synthesized with an excess of N^{15} in the 1- and 3-nitrogens as well as the 2-amino group. In another isotopic synthesis, excess C^{13} has been incorporated in the 2-carbon. 2,6-Diaminopurine is utilized by the rat for the biosynthesis of the guanine of both the pentose and desoxypentose nucleic acids, but does not lead to polynucleotide adenine. The biochemical implications of this finding are considered in the light of the pharmacological actions of 2,6-diaminopurine. 23 references. (auth)

5155 Oxidation of Isotopic Palmitic Acid in Animal Tissues. Sidney Weinhouse, Ruth H. Millington, and Murray E. Volk. J. Biol. Chem. 185, 191-200(1950) July.

A study of the oxidation of C^{13} labeled palmitic acid by various animal tissues in vitro revealed that in rat liver this acid can be converted both to carbon dioxide and to acetoacetate. In contrast with the lower fatty acids (up to C_4) which are transformed preponderantly to ketone bodies, palmitate is converted about equally to carbon dioxide and to acetoacetate by slices and homogenates of rat liver. In washed homogenates of rat liver, fumarate in low concentrations markedly accelerates oxidation of palmitate to CO_2 and at the same time decreases the formation of ketone bodies. This finding directly confirms previous evidence implicating the citric acid cycle in the oxidation of the natural fatty acids. Palmitic acid was found to be oxidized in vitro by a variety of tissues besides liver. 20 references. (auth)

5156 Oxidation in Vivo of the Methyl Groups of Choline, Betaine, Dimethylthetin, and Dimethyl-β-Propiothetin. Martha F. Ferger and Vincent Du Vigneaud. J. Biol. Chem. 185, 53-7(1950) July.

The synthesis of choline, betaine, dimethylthetin, and dimethyl-β-propiothetin labeled with C^{14} in one methyl group is described. The percentage of the methyl groups of these compounds which was expired as CO_2 by the rat over a period of 24 hr was measured. The methyl groups administered in the form of betaine, dimethylthetin, and dimethyl-β-propiothetin was found to be oxidized to a greater extent than the methyl groups administered as choline. A high degree of similarity was observed in the rates of oxidation of the methyl groups of betaine and the two thetins. (auth)

5157 Permeability of Frog Skin by Means of Radioactive Tracers. Russell E. Lux and John E. Christian. Am. J. Physiol. 162, 193-7(1950) July 1.

The permeability of the excised skin from the frog Rana pipiens is shown to vary widely among animals. Experiments using radioactive iodide indicate that this variation may be as extreme as 65% from the average response of 12 animals. The permeability of frog skin to iodide ion is increased approximately twofold by treating the skin with a saturated dextrone solution. The diffusion of I^- through frog skin proceeds approximately 4 times as rapidly as does Na^+. It is suggested that the frog skin bears a simulated positive charge, thus permitting the easier passage of I^-. Treating frog skin with different astringents was found to increase the permeability of the skin. This finding was independent of the orientation of the skin, the nature or concentration of the astringent, the type of tracer used or the means of applying the astringent. Radioactive tracers offer an excellent means of studying permeability problems. Such a method was found to be rapid, precise, and convenient. 12 references. (auth)

5158 Radioiodine Uptake Curve in Humans. I. Sources of Error in Collection of Data. William H. Beierwaltes, Isadore Lampe, Henry J. Gomberg, Robert A. Peelor, and Paul W. Brown. Univ. Hosp. Bull., Univ. Mich. 14, 73-5(1948) Aug. (See also NSA 4-2250; 4-2251.)

The authors discuss the errors involved in making measurements on radioiodine uptake in the thyroid of humans and suggest the following to eliminate some of the errors: (1) The patient should have had no extra iodine for at least 3 days, and no thiourea derivative for 2 weeks before examination. (2) He should ingest the iodine on an empty stomach. (3) A standard minimum quantity of radioactivity should be administered. (4) No carrier should be added, or if it is desired to trace the metabolic course of a large amount of iodine, a standard amount of a carrier should be added. (5) The age, height, and weight of the patient should be recorded for future references. 17 references. (auth)

5159 Radio-Potassium and the Isolated Frog Heart. I. Distribution of Potassium in the Organ and in Ringer's Solution. Pietro Benigno and Pascaline Daudel. J. physiol. et path. gen. 42, 233-42(1950) (in French).

In two series of experiments in which isolated frog hearts were placed in contact with Ringer's solution containing radiopotassium, the diminution of the concentration of K^{24}, as measured by the change of activity of the solution, was determined for constant, known initial concentrations at varying times, and for varying, known concentrations at constant times. The results are presented in complete tables and are discussed. It is shown that the percentage decrease in concentration is almost constant for varying concentrations of K^{24}, and that the decrease in activity of the solution is a measure of the fraction of potassium which is exchanged by the heart. The authors conclude that radioactive tracers permit the following of the exchange of cellular and extracellular K, and that the technique described may be used to

show the influence of given factors on equilibria which are subject to influence by these factors. 47 references.

5160 Radiopotassium and the Isolated Frog Heart. II. The Influence of the Anion and a Few Drugs on the Distribution of Potassium in Ringer's Solution and in the Organ. Pietro Benigno. J. physiol. et path. gen. 42, 243-48(1950)(in French).

In experiments using the technique previously employed (J. physiol. et path. gen. 42, 233(1950)), the effect on isolated frog heart-Ringer's solution equilibrium of the anion, which is in combination with the radiopotassium, was determined. The behavior of the anion and cation with respect to the heart was compared by means of a similar technique using the radiobromide of potassium. The results are presented in tables of the change of activity of the radioactive solutions with time. Using those tables of K^{24} concentration changes as controls, results are tabulated showing the effects of concentrations of adrenalin of 10^{-5}-10^{-9} g-molecules on the heart action and potassium uptake. The author concludes that the use of chloride, carbonate, sulfate, and bromide anions does not effect the radiopotassium of the Ringer's solution, nor is this equilibrium disturbed by adrenaline. It is shown that, for comparable concentrations, the decrease of the activity of the Ringer's solution containing the radiobromide of potassium is less than that obtained when using the bromide of radiopotassium.

5161 Rapid Diffuse Penetration of Intact Enamel and Dentin by Carbon 14-labeled Urea. William Ward Wainwright and Frank A. Lemoine. J. Am. Dental Assoc. 41, 135-45(1950) Aug.

Radioautographic studies of the penetration of radioactive urea, or substances derived from it, in 14 freshly extracted human teeth revealed the following: (1) Diffuse penetration of intact enamel occurs without the necessity of following lamellae or cracks. (2) This penetration of enamel takes place possibly within 10 min, and is rapid compared to the penetration of dyes which requires 10 to 30 days. This property is doubtless related to the higher diffusibility of urea and its smaller molecular size; which confirms the prediction of earlier workers that enamel is more permeable to small molecules. (3) Communications as disclosed by the passage of the radioisotope between enamel and dentin appear to be infrequent but were observed at various intervals in the sections, in some teeth as close together as 1 to 2 mm. (4) Penetration of the isotope through enamel into the dentin was more frequent near the gingival line and near occlusal fissures. (5) In one tooth the radioactive material was traced continuously from the occlusal surface through grossly intact, noncarious enamel and dentin to the pulp. The penetration occurred within 24 hr. A high concentration of labeled urea was maintained on the surface of the tooth and the pulp was not permitted to dry out. Pulp penetration was found in 3 other teeth and pulpal horns were penetrated in another. In 4 of the teeth there was a weak diffuse penetration throughout all of the dentin. (6) It is assumed that it is the urea molecule which has penetrated the teeth but, since the radioautograph detects only the radioactive carbon, further experiments will be necessary to substantiate this interpretation. (7) Radioactive materials and the radioautographic technic are highly effective tools for use in extending studies of enamel permeability. The combination provides a means

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of grossly visualizing the pathways by which nonstaining substances penetrate enamel. 23 references. (auth)

5162 Rate of Potassium Exchange of the Human Erythrocyte. John W. Raker, Isaac M. Taylor, John M. Weller, and A. Baird Hastings. J. Gen. Physiol. 33, 691-702(1950) July 20.

The exchange of potassium by the human erythrocyte has been studied in vitro using radioactive potassium. An incubation technique which maintains erythrocytes in an essentially normal state for more than 48 hr was employed. Exchange of radioactive potassium between the red cells and the extracellular fluid was regular and progressive, the specific activities of the intra- and extracellular fluids reaching equal values. This indicates that all the erythrocyte potassium is exchangeable and is exchanging at the same rate. From these data, it was calculated that at 37°C, 1.6% of the erythrocyte potassium exchanges per hour, corresponding to an exchange of 1.5 mM of potassium per liter of red cells per hour. The time required for the exchange of 50% of the red cell potassium is calculated to be 43 hr. The temperature coefficient (Q_{10}) of the potassium exchange rate is 2.2. This is the same as the temperature coefficient of the rate of utilization of glucose by the human erythrocyte. Varying the percentage of red cells, plasma potassium concentration, initial glucose level, and pH between 7.0 and 7.7 had no effect on the potassium exchange rate. 15 references. (auth)

5163 Studies of Plasma Volume Using Human Serum Albumin Tagged with Radioactive Iodine^{131}. Kenneth R. Crispell, Blanche Porter, and Robert T. Nieset. J. Clin. Invest. 29, 513-16(1950) May.

A method of the determination of plasma volume is described using human serum albumin tagged with I^{131}. The preparation of the tagged material, its stability, and physiological behavior are discussed, and the method is compared to the Evan Blue dye, T-1824, technique for plasma determinations. The authors conclude that the main advantage of this method is that it offers availability of repeated serial determinations with good accuracy.

5164 Studies with Radioactive Tracers in Plant Nutrition. I. Problems in the Use of Radioactive Tracers. R. Scott Russell and R. P. Martin. J. Exptl. Botany 1, 133-40(1950) June.

Tracer methods can yield valid results only if the behavior of the tracer within the plant is indistinguishable from that of the normal element. The extent to which radioactive isotopes satisfy this requirement must be considered from the following viewpoints: (a) their chemical and physical behavior before disintegration; (b) the effects of new substances formed by their disintegration; (c) the effects of the radiation they emit. Whereas, chemically and physically, isotopes with the exception of H^1 and H^3 satisfy this requirement, they may cause significant radiation damage even when supplied in low concentration if they are needed metabolically. The investigation of possible radiation effects is therefore an essential preliminary to all physiological investigations. The value of tracer methods is considered. (auth)

5165 Study of Fracture Healing by Means of Radioactive Tracers. Hans Bohr and August Halborg Sorensen. J. Bone and Joint Surgery 32A, 567-74(1950) July.

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Experiments with radiophosphorus (P^{32}) and radiocalcium (Ca^{45}) administered to rats at different periods during the healing of fractures, show increased activity of the bone ash from the fractured bone as compared with the ash from homologous intact bone of the same animal. Further investigations indicate that this effect is due mostly to an increased exchange of phosphorus and calcium between the plasma and the mineral substance of the bone. Measurements of the separated epiphysis indicate that this process involves the whole bone and the proximal epiphysis of the tibia as well. 13 references. (auth)

5166 A Study of the Metabolism of 2,4-Diaminopyrimidine. Aaron Bendich, William D. Geren, and George Bosworth Brown. J. Biol. Chem. 185, 435-8(1950) July.

A synthesis of 2,4-diaminopyrimidine, containing an excess of N^{15} in the 1 and 3 positions as well as in the 2-amino group, is described. Although the compound was extensively absorbed by the rat, the data presented indicate that 2,4-diaminopyrimidine is not metabolized to ammonia, urea, or allantoin, nor is it utilized for the biosynthesis of nucleic acids. 15 references. (auth)

5167 Techniques of Measuring Capillary Exchange with the Aid of Radioactive Tags. Francois F. Morel. Helv. Physiol. et Pharmacol. Acta 8, 52-73(1950).

The theory of the use of radioactive tags is developed mathematically according to the usual diffusion theory as applied to the exchange of substances in the blood across the capillary membrane, which gives for the general case $2.3\ k = V/v_2\ p$, where V is the total extracellular fluid volume, p is the fraction of the tracer amount in a blood plasma volume (v) which leaves v per unit time, k is the slope of the semi-logarithmic representation of the decreasing concentration of the tracer in the plasma, and v_2 is the volume of interstitial fluid under consideration. The theory is applied, as an example, to the particular case of radiosodium. An extensive discussion and description is then presented of experimental preparations, measurements, calculations, and methods of expressing results, including automatic graphing of results by means of a mechanical integrating device. It is shown that in measuring plasma concentrations of radiosodium in the rabbit both the mechanical integrator and the method of serial blood sampling give similar curves which agree with calculated equations, making it possible to measure the involved volumes and to calculate graphically the rate of the capillary exchanges of the tracer.

5168 Tracer Iron Distribution Studies in Irradiated Rats With Lead-Shielded Spleens. R. L. Huff, W. F. Bethard, J. F. Garcia, B. M. Roberts, L. O. Jacobson, and J. H. Lawrence. J. Lab. Clin. Med. 36, 40-51(1950) July.

A serial distribution study after a single intravenous injection of Fe^{59} was carried out in rats 3 days after 500 r whole body x-irradiation. Half of the rats were irradiated with their spleens exteriorized and protected. Appropriate controls were maintained. The animals having protected spleens showed a time-concentration relationship of tracer iron in the spleen which was almost identical to that of the bone marrow of control animals. Such was not found in those animals which received the same amount of irradiation without spleen protection. The red cells of the spleen-protected animals showed a significant concentration of tracer iron in contrast with those of the irradiated nonprotected animals. The livers of the irradiated, nonprotected animals accumulated 4 times as much tracer iron as the controls, but the irradiated spleen protected animals accumulated only 3 times as much. The bone marrow of the irradiated, nonprotected animals contained very little Fe^{59} at any time; yet the animals with protected spleens demonstrated the capacity to accumulate the tracer in their marrow. Methods are described for computing the liver iron turnover and the total body iron content. Corresponding values are given for normal female rats of the Curtis Dunning strain. 15 references. (auth)

5169 Turnover of Phosphatides. G. de C. Elliott and G. Hevesy. Acta Physiol. Scand. 19, 371-91(1950).

One-tenth ml physiological NaCl solution containing P^{32} of 2 μc activity and a negligible P^{32} content was administered to 100 rats of known age by subcutaneous injection. The results are described as follows: The extent of incorporation of intracellular orthophosphate P of the liver phosphatides of the rat decreases with increasing age. While it amounts to 12%/hr for the liver phosphatides of a 4-day-old rat, the corresponding figure for a 1.5-yr-old rat is 6, intermediate figures being obtained for rats of intermediate age. The calculation of the "rate of turnover" from the ratio of the end value of the specific activities of phosphatide P and the mean value of the specific activities of orthophosphate P during the experiment supplies, in experiments lasting 4 hr or less, almost identical figures with those obtained when, according to Zilversmit et al (J. Gen. Physiol. 26, 325,333 (1943) and J. Biol. Chem. 176, 193(1948)), the calculation is based on the change of the specific activity of phosphatide P with time. Replacement of the specific activities of liver inorganic P by corresponding value of ATP $P_{2,3}$ of the liver leads to very similar turnover rate values. The ratio of the turnover rate of the phosphatides of the total liver tissue, the mitochondria, and the cell nuclei of the liver was found to be: 0.67 : 0.42. The percentage of P^{32} administered present in 1 mg liver phosphatide P of the rat, which is as high as 0.121 after the lapse of 1 day, declines to 0.00066 after the lapse of 84 days. The lower limit of the turnover of kidney phosphatides is not markedly dependent on the age of the rat and amounts to about 5% in the course of 1 hr. Lower and with the age of the rat decreasing values are obtained for the spleen phosphatides. The percentage rate of incorporation of orthophosphate P per hr for a 3-month-old rat can be estimated to be about 4. 28 references. (auth)

5170 The Uptake and Elimination of Krypton and Other Inert Gases by the Human Body. C. A. Tobias, H. B. Jones, J. H. Lawrence, and J. G. Hamilton. J. Clin. Invest. 28, 1375-85(1949) Nov.

The rate of change of radioactive krypton concentration in the extremities of young male subjects has been studied. If the subjects breathed a constant concentration of radiokrypton, mixed with oxygen, the uptake and desaturation curves could be satisfactorily expressed as the sum of not more than three superimposed components, changing as the simple exponential function of time. Exercise or heating of the hand prior to the gas exchange resulted in a generally faster exchange. Vasoconstriction or adrenaline caused slower exchange. A fatty meal eaten 2 hr before the krypton exchange had no effect on the rapidity of the test. The gas exchange of some subjects

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slowed down while breathing oxygen at 35,000 ft simulated altitude. Radioactive krypton, administered via stomach tube appeared rapidly in the circulation of the extremities and in the exhaled air of the lungs. The techniques and results reported suggest that these radioactive gases have applications in the study of the circulation to the extremities in the living patient and in numerous problems of gas exchange in normal and pathologic states. 25 references. (auth)

5171 Use of Radioactive Phosphorus in Studies of Fetal Circulation. Newton B. Everett and Robert J. Johnson. Am. J. Physiol. 162, 147-52(1950) July 1.

Fetal guinea pigs and dogs near term were delivered by caesarian section under sodium pentobarbital (Nembutal) anesthesia with their placental circulation intact. Two-tenths cubic centimeter of physiological saline, labeled with radioactive phosphorus (P^{32}) was injected into either an umbilical or an external jugular vein. By using adapter tubes, 0.1-cc samples of blood were withdrawn simultaneously from both ventricles at short intervals after injecting the tagged saline. Approximately three-fourths of the umbilical vein blood passes through the foramen ovale to the left side of the heart and one-fourth reaches the right ventricle. Approximately three-fourths of the superior caval blood passes to the right ventricle and one-fourth transverses the foramen ovale to reach the left ventricle. In the fetal guinea pig blood from a locus in the umbilical vein passes to the left ventricle slightly in advance of that which passes to the right ventricle.

5172 The Utilization of Isovaleric Acid for the Synthesis of Cholesterol. Irving Zabin and Konrad Bloch. J. Biol. Chem. 185, 131-8(1950) July.

Doubly labeled isovalerate and foreign amines were fed to rats. The acetylamine was isolated from the urine, and cholesterol and saturated fatty acids were obtained from the liver. The isopropyl portion of isovalerate forms acetyl groups and fatty acids to the same extent as does acetate but is a much more efficient source of carbon atoms for cholesterol. The carboxyl portion of isovaleric acid is less efficientiy converted to acetyl groups, fatty acids, or cholesterol than either the isopropyl portion of isovalerate or acetate. After the administration of labeled acetone, the excreted acetyl groups, fatty acids, and cholesterol showed the same isotope concentrations as were observed after the feeding of labeled acetate. This result indicates that acetone is rapidly converted to a 2-carbon compound. C^{13}, C^{14}-Acetate was fed in order to compare the utilization of the 2-carbon atoms of acetate in these synthetic reactions. 14 references.

5173 The Zone of Localization of Antibodies. V. An Attempt to Saturate Antibody-Binding Sites in Mouse Kidney. David Pressman and Herman N. Eisen. J. Immunol. 64, 273-9(1950) Apr.

An attempt has been made to saturate the anti-kidney antibody-binding sites in the mouse kidney. The administration of even 15 mg of a globulin fraction of antimouse-kidney rabbit serum (G-anti-MK) did not saturate these sites, since this quantity of unlabeled anti-kidney antibody had no appreciable effect on the renal accumulation of radioactivity in animals that simultaneously were given radioiodinated G-anti-MK. A minimum value for the amount of antibody which can localize in the kidney was calculated, and was found to correspond to about 3% of the weight of a mouse's glomeruli.

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When large amounts (about 15 mg) of either G-anti-MK or globulin fraction of anti-mouse-spleen rabbit serum (G-anti-MS) were given along with radioiodinated G-anti-MK there occurred an unusually rapid decline in the blood levels of radioactivity, indicating a physiological effect of these sera. (auth)

5174 The Zone of Localization of Antibodies. VI. The Rate of Localization of Anti-Mouse-Kidney Serum. David Pressman, Herman N. Eisen, and Patrick J. Fitzgerald. J. Immunol. 64, 281-7(1950) Apr.

The rate at which antibodies to mouse kidney are extracted from the circulating blood was measured by using antibody tagged with radioactive iodine. It was found that the circulating blood was essentially freed of antibody within 18 min after intravenous injection. Some localization of the radioactive anti-kidney antibody in the glomeruli was observable within as little as 2.5 min after injection. (auth)

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5175 Demonstration of Exchange, Condensation, and Friedel-Crafts Reactions of Gaseous Organic Chlorides on Solid Aluminum Chloride. Monte Blau and John E. Willard. AECU-856, nd. 7p.

A variety of gaseous organic chlorides have been found to exchange chlorine with dry solid aluminum chloride. Some of these undergo condensation reactions on the surface with evolution of hydrogen chloride. Gaseous carbon tetrachloride and benzene have been found to undergo a Friedel-Crafts type reaction on an aluminum chloride surface. These observations are consistent with earlier work which suggested that an aluminum chloride surface is necessary for exchange between liquid carbon tetrachloride and aluminum chloride. (auth)

5176 Absorption Spectrum of Ferric Sulfate Complex. L. I. Katzin and Elizabeth Gebert. ANL-4457, May 22, 1950. 8p.

The following absorption measurements were made: (1) 0.000447M ferric iron in 0.001N to 2N solutions of perchloric acid. (2) 0.00046M ferric iron in mixed solutions of $HClO_4$ and H_2SO_4 ranging from 0 to 80% H_2SO_4. (3) 0.0004M ferric acid in 2N $HClO_4$ and in 1N $HClO_4$ and 1N HCl. The conclusion to be drawn is that under the conditions of the usual irradiation experiments in sulfuric acid the hydroxy complex seems to dominate the sulfate complex. However, exact distribution on the ferric iron between Fe^{+3} and the two complexes cannot be reliably derived from simple spectrophotometric measurements inasmuch as the spectra for the two complexes are not sufficiently distinct. Some indication was seen that in the presence of sulfate the slow reaction leading to colloidal ferric hydroxide was accelerated over the rate in perchloric acid alone. Presumably a charge effect of the anion, frequently observed with coagulation processes, is involved.

5177 Condensation Effected by the Alkali Amides. VI. Studies in the Acylation of Methyl 2-Thienyl Ketone. James K. Sneed and Robert Levine. NYO-650, Apr. 13, 1950. 7p.

A study has been made of the relative reactivity of a number of esters in the Claisen Condensation with methyl 2-thienyl ketone. For acetate esters the following order of reactivity

has been found: $C_6H_5 > CH_3 > C_2H_5 >$ iso-$C_3H_7 >$ t-C_4H_9. For esters of the type $RCO_2C_2H_5$ the order found is R-$CH_3 > C_2H_5 >$ iso-$C_3H_7 >$ t-C_4H_9. With aromatic esters of the structure R_{Ar} CO_2H_5 the relative reactivity is p-$ClC_6H_4 > C_6H_5 >$ p-$CH_3OC_6H_4$. The reactivity of the various esters parallels the results reported in the literature for the ammonolysis and alkaline hydrolysis of esters. A comparison between the ammonolysis and alkaline hydrolysis of esters with the Claisen acylation of ketones has been made. (auth)

5178 Anomalous Reactions of Phenetole Halides. A New Type of Ether Splitting. Maxwell Gordon. UCRL-768, June 22, 1950. 5p.

In an effort to prepare β-C^{14}-labeled phenoxypropionic acid for some mechanism studies an attempt was made to form the Grignard of β-bromo and β-chloroethyl phenyl ether with both simultaneous and subsequent carbonation. The cyanide reaction was also tried; the efforts met with failure in all cases. As a result of efforts to react β-bromoethyl phenyl ether with sodium cyanide a 30% yield of 1,2-diphenoxyethane, was isolated, identified by its crystal form, melting point, mixed melting point with an authentic sample, analysis, and infrared spectrum. Comparison is made with results obtained by Grignard (Compt. rend. 138, 1048 (1904)).

5179 The Lorentz Correction in Barium Titanate. J. C. Slater. Phys. Rev. 78, 748-61(1950) June 15.

It is assumed that the ferroelectric behavior of $BaTiO_3$ arises because of the Lorentz correction, leading to a vanishing term in the denominator of the expression for dielectric constant. If the polarizability varies slowly with temperature, the temperature variation of dielectric constant follows. This temperature variation is assumed to come from that part of the polarization resulting from the displacement of the Ti ion, in a field whose potential energy has fourth-power as well as second-power terms in the displacement. The main object of this paper is to compute the Lorentz correction exactly, not assuming spherical symmetry, but taking account of the precise crystal structure. When this is done, it is found that the Ti ions and those oxygen ions which are in the same line with them, the line being parallel to the electric field, exert very strong fields on each other, the resulting local field at the Ti ion being much greater than when computed on the assumption of spherical symmetry. This enhanced field makes it clear that even a relatively small ionic polarizability for the Ti ions will be enough to lead to ferroelectricity. (auth)

5180 Reactivity of Titanium Hydride with Air. Kermit Anderson and W. S. Fleshman. Ind. Eng. Chem. 42, 1381-3(1950) July.

A preliminary investigation of the rate of oxidation of the hydrides of tantalum, zirconium, columbium, and titanium in static laboratory air showed that titanium hydride was most resistant to oxidation. A further investigation of the reactivity of titanium hydride, using a dynamic method, indicated that, with dried air, reaction rate decreased with increasing density and increased with increasing temperature and air flow rate. The rate of reaction seemed to be strongly influenced by diffusional processes. Diffusion of decomposing hydrogen from within the pelletized sample and of atmospheric components across the gaseous boundary layer and into the sample were apparently important rate-determining processes.

5181 Metallic Filters - Their Fabrication and Uses. W. W. Wellborn and J. R. Armstrong. AECU-838, nd. 8p.

Various aspects of the problem of fabricating metallic filters which must be corrosion resistant, have good mechanical strength, and have a porosity to accommodate the separation of a finely divided precipitate (particle size 1 to 2 μ) from a solution, are considered. It was found possible to prepare powders for sintering which are in themselves porous. All the noble metals, iron, nickel, cobalt, copper, tungsten, molybdenum, and tantalum were successfully fabricated in this manner. The particles were obtained by decomposition of a compound of the metal which yields the metal and a gas. The effect of forming pressures on the sintered compacts is discussed. Some properties of platinum, gold, silver, and nickel filters are given. For illustration, a detailed method is given for the preparation of a 2½ in. diameter silver filter having the following characteristics: thickness, ¼ in.; porosity, 50%; average pore size, 8 μ.

5182 A Test for Traces of Organic Matter in Water. A. I. Medalia. AECU-864, nd. 10p.

Detection of small amounts of organic contaminants in water is of importance from the standpoints of potability, industrial use, or use as a solvent for reaction studies at high dilutions. A method is described by means of which traces of organic matter in water can be detected with greater sensitivity than by the customary permanganate test. The new method is based on the induced air oxidation of ferrous iron accompanying the reaction between ferrous iron and hydrogen peroxide, in the presence of organic compounds. Experimental results of testing the method both with and without the presence of chloride are included.

5183 Crystals and X-rays. K. Lonsdale. New York, D. Van Nostrand Co., 1949. 199p.

This book is based on a course of public lectures given at University College, London, in the spring of 1946, and is designed to interest those who do not now use x-ray crystallography but who might well do so, and to instruct those who are making use of x-ray crystallographic methods.

5184 A Direct Method for Determining Radium in Exposed Humans. Edwin R. Russell, Roman C. Lesko, and Jack Schubert. Nucleonics 7, No. 1, 60-4 (1950) July.

Radium in urine and other biological materials can be routinely determined by a rapid, sensitive method involving counting of alpha particles from the radium, following separation. The method consists of wet-ashing urine or tissues with concentrated nitric acid, dissolving the ash in 0.1M HNO_3, and coprecipitating the radium with lead sulfate; the lead sulfate precipitate is dissolved in HCl and the radium coprecipitated with a few milligrams of $BaCl_2$. The radium containing $BaCl_2$ precipitate is deposited on a platinum or glass disc and treated with H_2SO_4 to give a uniform adhering deposit. The sample is then counted in a proportional or parallel-plate pulse chamber. An alternative step for removing interfering anions involves the use of a

cation exchanger to adsorb the radium from the ashed solution, and subsequent elution of the radium with HNO_3.

5185 Fourier Technique in X-ray Organic Structure Analysis. A. D. Booth. New York, Macmillan, 1948. 106p.

This book gives a comprehensive account of the technique of organic crystal structure determination by Fourier methods, and indicates the relative scope of the various techniques. The treatment is from fundamentals, but the reader is assumed to have an adequate knowledge of geometric crystallography and of the theory of space groups.

5186 A Modified Apparatus for the Determination of Sodium Monoxide in Metallic Sodium. Dale D. Williams. Naval Research Laboratory, Jan. 16, 1950. 4p. (AEC File No. NP-1424.)

A revised apparatus has been constructed for use with the amalgamation method for separation of sodium monoxide as proposed by Pepkowitz and Judd (AECD-2660). The all-glass construction eliminates gas diffusion and purging problems, the longer reaction chamber eliminates errors from chance amalgam splashes, and operation in a vacuum eliminates most of the error resulting from impure cover gas. A modified technique for operating the apparatus is also given in detail. Some results of routine analyses using the modified apparatus and technique are included.

5187 The Classification of the Last Elements of the Periodic System. M. Haissinsky. J. chim. phys. 47, 415-8(1950) May-June (in French).

It is shown that the elements Ac, Th, Pa, and U cannot be grouped in a homogeneous chemical family analogous to the lanthanides and that the existence of a new "rare earth" series beginning with uranium must be postulated. The charactersitic properties of this series are described. (auth)

5188 Contribution to the Synthesis of Organic Deuterium Compounds. I. Deuteropolymethylene. Leonard C. Leitch, Paul E. Gagnon, and Adrien Cambron. Can. J. Research 28B, 256-63(1950) June.

An improved method of preparing polymethylene, $(CH_2)_n$, by the decomposition of diazomethane is described. A new polymer, polyethylidene, $(CH_3\,CH)_n$, has been obtained from diazoethane by the same reaction. Diazomethane-d_2 is reported for the first time. A new deuterated polymer, $(CD_2)_n$, obtained by the decomposition of diazomethane-d_2 has been synthesized. 13 references. (auth)

5189 Pyrolysis of Hexadecafluoroheptane. II. D. V. Walker and J. D. Gibson. K-576, May 31, 1950. 10p.

The pyrolysis products of hexadecafluoroheptane have been studied at temperatures from 500 to 800°C, space velocities of 0.206 to 1.466 ml/hr/cc reactor volume, and at atmospheric and 100 psi pressures. The reactor consisted of an electrically heated 1-in. monel pipe 65 in. long, packed with monel chips; the free space was 89.5%. The hexadecafluoroheptane was decomposed to lower molecular weight fluorocarbons, both saturated and unsaturated, containing 1 through 5 carbon atoms. Compounds containing 3 and 4 carbon atoms comprised the greatest part of the

product. An increase in pyrolysis temperature caused an increase in the amount of low boiling products while an increase in the space velocity caused a decrease in the amount of low boiling compounds. The greatest yield of C_3 fluorocarbons was 18.2 wt % obtained by pyrolysis of the hexadecafluoroheptane at 650°C and 1.466 ml/hr/cc reactor volume. An increase in pressure and space velocity at constant temperature resulted in greater decomposition of the hexafluoroheptane. Since an increase in space velocity at constant temperature and pressure causes the per cent decomposition to decrease, it was assumed that at constant temperature and space velocity an increase in pressure would result in a higher per cent decomposition. This would be expected, as the contact time would be higher with the higher pressure. (auth)

5190 The Micro Determination of Fluorine in Solid Halocarbons. R. R. Rickard, F. L. Ball, and W. W. Harris. K-610, May 31, 1950. 15p.

A colorimetric method for the micro determination of fluorine in solid halocarbons has been developed. The sample was decomposed in a stream of superheated steam forming hydrogen fluoride which was absorbed in a ferric ion-salicylic acid solution. Fluoride was determined by measuring the change in light absorbancy of this solution. The precision of the method was 3.9% of the fluorine present on a 95% confidence interval. This method for the determination of fluorine is applicable to organic compounds that may contain chlorine, bromine, and nitrogen, in addition to carbon and fluorine. Sulphur and phosphorus interfere by acting as reducing agents. 20 references. (auth)

5191 Some Physical Properties of Hexadecafluoroheptane. S. Blumkin and G. D. Oliver. K-611, June 5, 1950. 14p.

The boiling point, freezing point, and infrared absorption spectrum of hexadecafluoroheptane of purity of 99.92 mole % are reported. Also given are the densities and the refractive indexes for the sodium D, the mercury e and g, and the hydrogen C and F lines, at 20.0, 25.0, and 30.0°C. All these properties differ significantly from previously reported data obtained on samples of lesser purity. The specific and molar properties are calculated and comparison is made with the properties of n-heptane. (auth)

5192 Low Temperature Thermal Data on Chlorine Trifluoride. G. D. Oliver, J. W. Grisard, and H. A. Bernhardt. K-612, June 12, 1950. 14p.

Molal heat capacity measurements were made on chlorine trifluoride from 14°K to the boiling point, 284.91 ± 0.05°K. An isothermal transition found at 190.50 ± 0.05°K absorbed 360.5 cal/mole. The heat of fusion value of 1819.3 cal/mole was determined at a triple point of 196.84 ± 0.05°K for the pure material. At the boiling point, the total entropy for the liquid was 43.66 ± 0.10 cal/deg mole, and for the ideal gas 66.87 cal/deg mole. 13 references. (auth)

5193 The Vapor Pressure and Heat of Vaporization of Chlorine Trifluoride. J. W. Grisard, G. D. Oliver, and H. A. Bernhardt. K-613, June 23, 1950. 13p.

The vapor pressure of chlorine trifluoride has been investigated over the pressure range 30 to 1530 mm, and the equation

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$$\log_{10} p_{mm} = 7.36711 - 1096.917/(t + 232.75)$$

was derived to represent the data. The heat of vaporization at the boiling point, 11.75°C was calculated to be 6580 cal/mole using the exact Clapeyron equation. 12 references. (auth)

5194 Conference on Fluorides and Fluorocarbons. Office of Naval Research, nd. 39p. (AEC File No. NP-1588.)

At this conference, held at the Department of the Navy, January 27 and 28, 1949, the following papers were presented: Introduction to the Discussion of the Preparation of Fluorides and Fluorocarbons, by George H. Cady; Direct Fluorination of Organic Compounds, by Lucius A. Bigelow; Production of Fluorocarbons by Electrolysis of Hydrogen Fluoride Solutions, by N. W. Taylor and W. Pearlson; Chlorofluorocarbons and Trifluoroacetonitrile, by Earl T. McBee; Trifluoromethyl Biphenyls, by Charles K. Bradsher; Fluorinated Aromatic Compounds, by Glenn C. Finger; Fluorine-Containing Silicon Compounds, by H. S. Booth; Heterocyclic Compounds Containing Fluorine, by Arthur Roe; Preparation of Fluoro-Olefins, by Albert L. Henne; Chemical Properties of Fluorides and Fluorocarbons, by William T. Miller; The Addition of Organic Molecules to Fluoro-Olefins, by Paul Tarrant; The Thermal Decomposition of Fluorocarbons, by George H. Cady; Inorganic Fluorides, by K. E. Long; Determination of Fluorine in Organic Compounds, by John H. Saylor; Fluorinated Groups in Relation to Functional Groups in the Molecule, by Albert L. Henne; The Fluorobutadienes, by William T. Miller; Introductory Remarks on Physical Properties of Fluorides and Fluorocarbons, by Marcus E. Hobbs; Physical-Chemical Properties of Organic Fluorine Compounds, by J. R. Lacher; Viscosity of Fluorocarbons by William A. Zisman; Infrared and Raman Spectra of Fluorine Compounds, by Don C. Smith; Determination of the Raman Spectra of Fluorocarbons, by J. Rud Nielsen; Comparison of the Physical Properties of Isomers, by George H. Cady; Solubility of Some Organic Compounds, by J. H. Saylor; Introductory Remarks on Applications of Fluorides and Fluorocarbons, by William Hanford; Sources of Fluorine, by Glenn C. Finger; Fluorides as Heat Transfer Fluids and Lubricants, by William A. Zisman; Fluorocarbons in the Laboratory, by William T. Miller.

5195 Electrical Breakdown in CSF_8. Ronald Geballe and Fred S. Linn. J. Applied Phys. 21, 592-4(1950) June.

The breakdown potential of a new gas, CSF_8, has been measured over the range from $p\delta$ = 4 to 200 mm × cm under conditions approximating plane-parallel geometry. A comparison of breakdown in air, Freon-12, and CSF_8 in the same apparatus indicates the ratio of the strengths of these gases to be approximately 1:2:3, respectively. CSF_8 decomposes rapidly during breakdown into CF_4 and SF_4 with a consequent doubling of pressure and appreciable increase in breakdown potential.

5196 The Fluorocarbons. J. H. Simons. Chem. Eng. 57, No. 7, 129-36(1950) July.

Some properties (boiling and freezing points, refractive indexes, viscosities, surface tensions, solubilities) of fluorocarbons are described and various possible commercial uses are mentioned.

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5197 Iodine Heptafluoride Preparation and Some Properties. Walter C. Schumb and Maurice A. Lynch, Jr. Ind. Eng. Chem. 42, 1383-6(1950) July.

Iodine pentafluoride, as one of the interhalogen compounds, has chemical interest both of a theoretical and practical nature. It is unique in being the only simple binary compound in which sevenfold co-ordination is exhibited, and in common with other halogen fluorides it is a possible substitute for fluorine in certain fluorination processes. A detailed account of the preparation and purification of iodine heptafluoride from the pentafluoride is presented. No stable addition compounds of the type $M(IF_8)$ were obtained from the interaction of iodine heptafluoride and several alkali halides. The reactions between iodine heptafluoride and several chlorofluorocarbons are presented along with a brief synopsis of previous work. (auth)

5198 The Ultraviolet Absorption Spectra of the Monofluoropyridines and the Monofluoroquinolines. William K. Miller, Samuel B. Knight, and Arthur Roe. J. Am. Chem. Soc. 72, 1629-33(1950) Apr.

The ultraviolet absorption spectra of the isomeric fluoropyridines and fluoroquinolines as well as those of 2- and 6-chloroquinoline have been measured. Curves are included. The fluorine atom produces a bathochromic shift of the pyridine maximum in either the 2- or 3-position in the pyridine series, but no such regularity is observed in the quinoline series. The change from 10 to 95% alcohol as solvent produces a change in the spectrum of each compound. Spectrophotometric evidence indicates that 2-fluoroquinoline forms a hydrochloride in 10% ethanol, but that 2-fluoropyridine does not. (auth)

5199 Four-Unit Plating Controls, PC-4 and PC-5. J. W. Heyd, P. E. Ohmart, and C. E. Hites. MLM-467, Aug. 1, 1949. 103p.

The four-unit plating control is a completely electronic device which will control four simultaneous electroplating operations, maintaining the solution cathode potential of each cell at a constant predetermined value over a wide range of the ionic concentration of the solution. Complete operating instructions, testing procedures, and specifications are given.

5200 The Kinetics of the Exchange Reaction Between the Two Oxidation States of Cerium in Acid Solution. J. W. Gryder and R. W. Dodson. AECU-839, nd. 29p.

The rate of exchange between cerous and ceric cerium in nitrate and perchlorate systems has been found to be measurable at zero degrees and to be complete within a few minutes at room temperature. The reaction order has been determined with respect to cerium III and cerium IV and the data interpreted on the basis of an electronically activated state of cerium III. Supporting evidence is given from spectral data. The acid dependence of the reaction has been determined and a tentative explanation on the basis of hydrolysis advanced. Other interpretations are not excluded. Entropies of activation have been calculated and compared with those obtained for similar reactions. Steric factors and charge product have been stressed as being responsible for values reported. 24 references. (auth)

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5201 Note on the Ion Exchange Separation of Europium, Gadolinium, and Terbium. G. H. Higgins and K. Street, Jr. UCRL-664, Apr. 24, 1950. 6p.

The results of an elution of yttrium, terbium, gadolinium, and europium made at 97°C using 5% ammonium citrate solution of pH 3.25 are presented. Tracer Y^{91}, Gd^{153}, and $Eu^{152-154}$ were used in addition approximately 200 μg amounts of stable terbium, gadolinium, and europium were added to make spectrographic identification of the peaks possible. The column used was 20 cm long and 5 mm in diameter and a flow rate of 0.3 ml/cm^2/min was maintained. These results are compared with results obtained by Ketelle and Boyd (J. Am. Chem. Soc. 69, 2800(1947)).

5202 Observations on the Rare Earths; Studies in Ion Exchange. Arthur Edwin Taylor. University of Illinois, Feb. 1, 1950. 25p. (AEC File No. NP-1434.)

Amberlite IR 100-H and Dowex-50 were employed as cation exchangers for the separation thorium and rare earths (lanthanum, praseodymium, neodymium, samarium, and cerium). Eluting agents used included citric acid, ethylene diamine tetraacetic acid, ammonium oxalate, ammonium carbonate and hydrochloric acid. The following results and conclusions were obtained: (1) Citric acid solutions within a definite pH range are suited for the fractionation of the rare earths in the ion-exchange procedure, using the resin Amberlite IR 100-H. (2) A 2% citric acid solution at pH 2.99 produces a better fractionation of the cerium group rare earths than does a 5% solution at pH 2.69. (3) The possibility that the presence of cerous cerium will improve the separation of praseodymium and lanthanum in the ion-exchange procedure was not definitely established. (4) Ethylene diamine tetraacetate solutions are suitable for the removal of strongly absorbed cations such as cerium and thorium from the resin Dowex-50. (5) Saturated ammonium oxalate solution at pH 6.3 is an inefficient eluant for the removal of thorium from Dowex-50 resin. (6) Three normal hydrochloric acid will not remove thorium from Dowex-50 resin. (7) Ammonium carbonate solutions are capable of removing thorium from the resin Dowex-50 in a characteristic sigmoidal curve. (8) The pH of the eluant is an important factor in ion-exchange experiments. (9) The flow rate of the eluant through the resin greatly affects the character of the elution curves obtained. In general, as the flow rate decreases, the solution and resin approach equilibrium, and the shape of the elution curves becomes more symmetrical. (10) Comparison of the experiments involving the elution of thorium from the exchanger Amberlite IR 100 and from the exchanger Dowex-50 show that thorium is more strongly attached to the latter resin. 31 references.

5203 The Rare Earth Metals and their Compounds. XII. Carbonates of Lanthanum, Neodynium and Samarium. Murrell L. Salutsky and Laurence L. Quill. J. Am. Chem. Soc. 72, 3306-7(1950) July. (Note)

The hydrolysis of rare earth trichloroacetates $[Nd(C_2Cl_3O_2)_3]$ in a homogeneous phase reaction yields a pure crystalline carbonate:

$$2Nd(C_2Cl_3O_2)_3 + 3HOH \rightarrow 3\,CO_2 + 6CHCl_3 + Nd_2(CO_3)_3$$

The analyses for lanthanum, neodymium, and samarium carbonates so obtained are listed. The preparation of rare earth normal carbonates by the decomposition of the trichloroacetates from hot water solution is very satisfactory since no interfering ions, such as the alkali ions, are introduced into the reaction mixture.

5204 A Rare Earth Separation by Anion Exchange. E. H. Huffman and R. L. Oswalt. UCRL-685, May 2, 1950. 5p.

A separation of Pm^{147} and Eu^{154} in tracer quantities by development of their citrate complexes at pH 2.1 on an anion exchange column has been accomplished. A solution of the tracers Pm^{147} and Eu^{154} in 0.25 ml of 0.0125M citric acid, adjusted to pH 2.1 with hydrochloric acid (final chloride concentration about 0.003M), was put on a column of 250 to 500 mesh Dowex A-1 resin 14.9 cm long and 0.08 cm^2 cross section. This column had been prepared by treating the original chloride form of the resin with citrate solution of the same concentration and pH. Elution was performed at the rate of 1.5 ml per hr with the same citrate solution.

5205 Use of Alumina Columns in Chromatography. David Kritchevsky and Eugene C. Jorgensen. UCRL-712, May 22, 1950. 9p.

This report is an attempt to systematize the most popular current techniques for the preparation of alumina, testing and chromatographic procedures.

5206 Complete Separation of Alkali Metals by Ionic Exchange. Georges Kayas. J. chim. phys. 47, 408-10(1950) May-June (in French).

Amberlite IR 100 was used as the cation exchanger with the chlorides of Na, K, Rb, and Cs (using Na^{24}, K^{42}, Rb^{86}, and Cs^{134} as tracers) in a resin ion exchange column. The elution was carried out by a 0.1N HCl solution for K and Na and a 1.0N HCl solution for the Rb and Cs. The rate of elution and efficiency are discussed.

5207 An Improved Synthesis of Glycine-1-C^{14} and Glycine-2-C^{14} from C^{14}-Labeled Acetic Acid. B. M. Tolbert and D. M. Hughes. UCRL-705, May 16, 1950. 9p.

A modified procedure for the synthesis of labeled glycine from acetic acid is presented which gives a high purity product and is reliable in routine use. In an attempt to simplify the procedure described by R. Oswald (J. Biol. Chem. 173, 207(1948)), to make it more reliable for routine use and to increase the yield, the following modifications were developed: (1) An improved method of generating the acetic acid from the sodium acetate; (2) The use of acetyl chloride to remove small amounts of water from the acetic acid before chlorination; and (3) Ion exchange columns and high vacuum sublimation purification which eliminated all ammonia salts in the product.

5208 Exchange Reactions of Tetracyanonickelate Ion; The Structure of Nickel Cyanide. F. A. Long. AECU-848, nd. 16p.

The exchange of cyanide between tetracyanonickelate ion and cyanide ion has been studied using a solvent extraction procedure for removing the cyanide as hydrocyanic acid. Ni^{63} was used as a radioactive tracer in these studies. The exchange with cyanide ion was found to be very fast in agreement with previously reported results. The exchange of nickel between tetracyanonickelate ion and hydrated nickel

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ion is slow compared to the rate of the precipitation of nickel cyanide which occurs when these ions are mixed. The results lead to the conclusion that solid nickel cyanide contains two nonequivalent kinds of nickel and this is strong evidence that the solid nickel cyanide is really nickel tetracyanonickelate. The exchange of tetracyanonickelate ion has been studied at room temperature with 4 complex nickel ions of lower stability: nickel ammonio ion, trisethylenediaminonickelate ion, bisoxalatonickelate ion and the nickel tartrate complex ion. For the first two the exchange is very fast but is slowed down to a measurable rate by addition of neutral salt. For the last two the exchange is quite slow but is speeded up considerably by addition of neutral salt. These facts suggest that a direct bimolecular interaction is a plausible mechanism for the exchanges.

5209 Observations on the Exchange of Mercury Between Phenyl Mercuric Chloride and Mercuric Chloride Using Mercury 203. J. M. Cross and J. J. Pinajian. AECU-863, Apr. 26, 1950. 9p.

There is evidence to indicate that the phenyl mercuric ion has a relatively high germicidal value against certain pathogenic bacteria and a relatively low toxicity to human tissue. As a preliminary study of the action of these phenyl mercuric salts, the exchange of Hg between phenyl mercuric salts and mercuric salts has been investigated by the use of radioactive Hg^{203}. The reaction

$$C_6H_5HgOAc + Hg^{203}(OAc)_2 \rightleftarrows C_6H_5Hg^{203}OAc + Hg(OAc)_2$$

was found to come to equilibrium within the time required to mix and separate the components (about 1 min). This rapid exchange was found in four solvents: glacial acetic acid, 50% ethanol, water, and benzene. The exchange was so rapid that no study of the rate could be made. The exchange between phenyl mercuric chloride and mercuric chloride was found to be slower and several time-exchange curves in benzene were obtained. When the reactants (phenyl mercuric chloride and mercuric chloride) were present in equimolar concentrations (0.01M) in the solvent benzene the following data were obtained:

Solvent	Temperature	Half time for exchange
Dry benzene	24.6°	37.5 minutes
Wet benzene	24.6°	37.0 minutes
Dry benzene	44.6°	18.0 minutes
Dry benzene 0.01MHCl	24.6°	0.8 minutes

The presence of water had little or no effect on the rate of the exchange. The presence of HCl greatly increased the rate of the exchange. (auth)

5210 The Epimerization of Glucose-1-C^{14}. Aksel A. Bothner-By and Martin Gibbs. AECU-867, nd. 2p.

This is not an abstract; the document is reproduced below in its entirety.

The mechanism (or mechanisms) by which the epimerization of glucose proceeds in alkaline solution is not clearly established, the commonly accepted intermediate formation of an enediol being inconsistent with the results of the investigations of Fredenhagen and Bonhoeffer (Z. Physik. Chem., A181, 392(1938)) concerning the conversion of glucose to fructose in heavy water. A rearrangement of the carbon chain of glucose during the course of the reaction has not been excluded by any earlier work and could conceivably occur. Such a rearrangement would be detectable using glucose-1-C^{14} which has recently become available (Sowden, Science, 109, 229(1949)). We have performed this experiment and our results indicate that no rearrangement takes place.

Experimental. 1.3 mg of glucose-1-C^{14} having a specific activity of 120 $\mu c/mg^3$ was diluted with 30 mg of inactive glucose and dissolved in 0.2 ml of saturated calcium hydroxide solution. The solution was kept at 70° for 2 hr (DeBruyn and Van Ekenstein. Rec. trav. chim., 14, 203 (1895)), then chilled and passed over 1 g each of Amberlite IR-100-H and IRA-400 ion exchange resins. The volume with washings was 6 ml. The mixed sugars were diluted with 25 mg cold glucose and were degraded by the method of Wood, Lifson, and Lorber (J. Biol. Chem., 159, 475(1945)). The specific activities obtained were: for the glucose carbon atoms 1 and 6, 4.4 $\mu c/mg$ of carbon; carbon atoms 2 and 5, 0.1 $\mu c/mg$; carbon atoms 3 and 4, 0.09 $\mu c/mg$. A similar distribution of label in the lactic acid was obtained by degrading glucose-1-C^{14} which had not been epimerized. (auth)

5211 The Mathematical Basis of the Interpretation of Tracer Experiments in Closed Steady State Systems. C. W. Sheppard and A. S. Householder. ORNL-716, June 27, 1950. 53p.

The study of the process of mixing of tagged and untagged species of a substance S whose concentration may vary spacially throughout the system following the local introduction of an aliquot of isotopically labeled material. The problem is essentially one of mixing by exchange in a closed system where S does not flow in or out through the enclosing boundaries. 18 references.

5212 Isotopic Exchange between Selenium and Its Ions in Aqueous Solution. M. Haissinsky and A. Pappas. J. chim. phys. 47, 506-13(1950) May-June.

The effect of acidity on the isotopic exchange between SeO_3 in a hydrochloric acid solution and amorphous selenium powder labeled with radioactive Se^{75} was investigated. Experiments were also conducted on the exchange between selenium and the polyselimides (Se^{-2}). The results and the effect of temperature on exchange are discussed.

5213 Isotopic Tracer Technique. H. R. V. Arnstein and R. Bentley. Quart. Revs. 4, 172-94(1950).

A review is given of the use of D, N^{15}, C^{13}, and O^{18} as tracers in the fields of chemistry and biochemistry. The synthesis of labeled compounds and the limitations of tracer techniques are discussed. 192 references.

5214 The Vapor Pressure of Americium. N. D. Erway and O. C. Simpson. J. Chem. Phys. 18, 953-7(1950) July.

The vapor pressure of americium from a dilute solution in plutonium has been measured by a modification of the Knudsen effusion method. The resulting vapor pressure for pure americium in the temperature range 1450 to 1820°K is given by the equation $\log_{10} p_{mm} = 7.02 - (11,300)/T$. The vapor pressures are probably accurate to a factor of 2 or 3. Relative values are much more precise.

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5215 Efficiency of Filtration Methods for the Collection of Atmospheric Impurities. Sidney Laskin, Paul B. Frank, and Robert H. Wilson. AECU-860, Apr. 25-27, 1950. 2p.

The document is in abstract form; it is reproduced below in its entirety.

Available information on sampling atmospheric impurities by filter paper methods has indicated that numerous intimately related variables affect efficiency of collection. These include such factors as the type of paper, sampling velocity, relative humidity, particle size and physical properties of the contaminant, and possibly atmospheric concentrations.

To elucidate this problem, studies using a filter paper sampling train followed by a flame photometer were made to evaluate end losses. Sodium chloride aerosols at an average relative humidity of 82% were selected to permit simple analysis with the flame photometer. Particle-size measurements obtained from electron micrographs of samples collected with a thermal precipitator showed a mass median diameter of 0.30 μ and a geometric standard deviation of 1.74. Under these conditions, experimental data showed that the penetration losses to the flame photometer remained constant irrespective of the amount collected on the filter paper up to a 2.5 mg sample. The flame photometer was found to have a limit of sensitivity equivalent to 30 μg NaCl/m^3 and a standard error determined from known solutions of 2.2%.

The studies thus far have been limited to the effects of sampling velocity and concentration on the efficiency of Whatman No. 41 filter paper. Aersol penetration of progressive numbers of elements of a filter paper train were measured by the flame photometer at a sampling velocity of 39.2 cm/sec from a concentration of 43 mg/m^3. The concentration passing the first paper decreased from 2.84 to 0.03 mg/m^3 passing the sixth paper, which represented the limit of sensitivity of the flame photometer and only 1% of the amount passing the first element. A plot of the cumulative total efficiency of the train showed a value of 99.93% for six papers. The curve rises rapidly from 93.4 and above four elements approaches the 100% value asymptotically. To permit analysis of samples collected by bilter paper trains only, the concentrations collected on each of the elements in these studies were expressed as the cumulative percentage increase above the value of the first paper. A plot similarly shows the increase in efficiency with increasing number of elements of the filter paper train, approaching a limiting value of 7.1% asymptotically. The efficiency of a single paper obtained from this value, of 93.3%, is in excellent agreement with that obtained from the flame photometer results.

Detailed analysis of samples collected with the multiple filter paper train only was made at an average concentration of 29.8 mg/m^3. Sampling velocities at 8 points from 7.2 to 140.8 cm/sec was explored using trains of from 5 to 10 filter papers. Plotting the concentrations collected on each element, as above, a family of curves were obtained each of which approach a limiting value asymptotically. These results led to the use of this limiting value to determine the efficiency of the initial element. The number of elements required to sample the atmosphere completely was found to be directly related to the sampling velocity. Thus at 140.8 cm/sec, the initial paper showed an efficiency of 99.6% and a minimum of 2 papers was required for significant results, whereas at 7.2 cm/sec the initial paper showed an efficiency of 71.3% and a minimum of 8 papers was required. A range of sampling velocities from 7.2 to 142 cm/sec were explored with more than 140 determinations made at 15 sampling velocities in order to obtain statistically significant results. Typical data of 9 samples at 38.1 cm/sec showed a range of velocities maintained from 37.0 to 41.0 cm/sec with efficiencies of from 93.2 to 96.9%. The mean results show a rapid increase in efficiency with increase in sampling rate from 7.2 cm/sec up to 36 cm/sec with efficiencies of 73.3 and 94.5% being found, respectively. With further increase in sampling velocities, the efficiency increased more slowly, gradually approaching 100% with the highest recorded value being 99.6% at 142.4 cm/sec.

Concentration studies to date on the effect of sampling velocity on efficiency at levels of 31.0 and 10.8 mg/m^3 do not show that efficiency varies with concentration.

5216 Mutual Interests between the Water-Works and Atomic-Energy Industries. Arthur E. Gorman. J. New Eng. Water Works Assoc. 64, 148-63(1950) June.

The impact of the atomic-energy industry upon the long established and well organized water-works industry has been slight but the possibilities are great. So far, AEC has constructed its own water-utility systems at the more or less isolated plants and a large body of experience is building up. Radioactive waste disposal is discussed, and the need is emphasized for training, within the water-works industry, before radiological research is undertaken.

5217 Heat Transfer to Liquid Metals in Concentric Annuli. Raymond V. Bailey. ORNL-521, June 13, 1950. 45p.

A theoretical analysis of concentric annuli is made to present: (1) rigorous equations based on the ideal system, for the calculation of heat transfer; (2) equations for the approximation of eddy diffusivity and velocity profiles for turbulent flow of fluids in annuli; (3) rigorous equations for velocity profile and friction factors of fluids in laminar flow; (4) a simple empirical equation to approximate the heat transfer to liquid metals in annuli. The scope of the treatment of turbulent flow is: (1) Reynolds moduli —10^4 to 10^6; (2) Peclet moduli —0 to 10^4; (3) Diameter Ratios —1 to 25. 14 references. (auth)

5218 Some Physical-Chemical Aspects of Cotton Detergency. Cationic Adsorption and Exchange as Shown by Radiocalcium Tracer Studies. Joseph M. Lambert. Ind. Eng. Chem. 42, 1394-8(1950) July.

Radioisotope tracer methods are described for measuring the adsorption and exchange of calcium (Ca^{45}, item S-5B) on cotton as it occurs in laboratory wash tests simulating hard water laundering. Results are presented which were obtained with several cotton detergents in multicycle wash tests. Varying amounts of calcium are adsorbed depending on the detergent and on the condition of the cloth (new or used cotton). A tentative interpretation of these effects is offered as well as a discussion of possible extensions of the method.

5219 Preparation of High Purity Magnesium and a Study of the Effect of Non-Metallic and Alkali Metal Impurities on the Corrosion Characteristics of Pure Magnesium. First Quarterly Report (Dec. 1, 1949 - Feb. 28, 1950). Dow Chemical Company. COO-13, nd. 24p.

An experimental sublimation furnace, and a gas purification train have been constructed. Further effort has been directed toward the evaluation of various corrosion testing methods and to the development of a new method which would be better adapted to the particular needs of the problem. Standard methods of spectrographic, microchemical, neutron activation and x-ray analysis are being used to evaluate the purity of the materials under study. Attempts are being made to develop better methods for concentrating impurities in an effort to increase the sensitivity of the analytical procedures for the contaminants to be studied. 12 references. (auth)

5220 Research Creep of Alloys. Technical Progress Report. February 1, 1950 to April 30, 1950. E. R. Parker and T. H. Hazlett. COO-12, May 1950. 4p.

The following topics are discussed: (1) the nickel test program, (2) single crystal studies, and (3) theoretical studies on crystals and plastic flow.

5221 Fundamental Research in Physical Metallurgy, Sixth Quarterly Report (Progress Report Number 23). J. H. Hollomon and D. Turnbull. SO-2000, July 5, 1950. 12p.

No dependence of grain-boundary self-mobility in silver on purity or grain size has been found. Activation energies for self-diffusion in metals can be satisfactorily described by a linear combination of the heat of sublimation and the C_{44} shear modulus. A comparison has been made of the degree of local order in Cu_3Au above the ordering temperature calculated from x-ray and activity data. Evidence has been found that there is a wide spread in the grain-boundary energies measured in annealed compression-rolled copper, possibly due to the dependence of boundary energy on relative orientation of adjacent grains. The free energy of the noncoherent twin boundary in copper was found to be 0.80 ± 0.02 times the average grain-boundary energy. In aluminum the coherent twin boundary energy is 0.21 ± 0.05 times the average grain-boundary energy. (auth)

5222 Ductile Vanadium Comes of Age. Westinghouse Engr. 10, 175(1950) July.

A new process in the preparation of vanadium results in a fine, powdered metal, scarcely more coarse than talcum powder. Essentially this process consists of reducing the starting product of vanadium pentoxide (V_2O_5) to the trioxide by reaction with hydrogen, and then completing the reduction with metallic calcium and calcium chloride. The product is pure vanadium, which can be formed into ductile wire or sheet by conventional powder metallurgy and rolling operations. (auth)

5223 Metallic Creep and Creep Resistant Alloys. A. H. Sully. New York, Interscience Publishers, 1949. 278p.

In this book the author has attempted to present the viewpoints of both the industrial worker and the academic researcher in the field of creep resistant alloys. The development of the existing theory of the strength of metals is described with special reference to creep, and an attempt has been made to explain certain metallurgical factors affecting creep on the basis of this theory. A detailed summary of experimental techniques for the study of creep phenomena has also been included as well as a survey of the creep properties of most of the well-known ferrous and nonferrous alloys. Some speculations on future developments in creep-resisting alloys are made.

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5224 Progress in Metal Physics. I. Bruce Chalmers. New York, Interscience Publishers, 1949. 401p.

The purpose of this volume, which is to be the first of an annual series, is to present authoritative reviews of the present state of knowledge in specialized aspects of the field that includes both physical metallurgy and metal physics. Nine authors have contributed chapters.

5225 The Determination of U_3O_8 in Ores and Solutions; Cellulose Column Method. F. T. Rabbitts, R. J. Guest, J. E. Jordan, E. D. Kornelsen, E. Proulx, G. R. Lachance, and W. B. Rice. Department of Mines and Technical Surveys (Canada) Memorandum Series No. 105, Sept. 2, 1949. 17p. (AEC File No. NP-1529.)

An analytical procedure is described which gives a considerable saving in time and reagents compared with previous methods and yields results of improved accuracy and precision. In addition it is applicable to any concentration of uranium in ores and solutions. The sample is brought into solution by a suitable method. If arsenic is absent, it is preferable to obtain a nitric acid solution free of chlorides and sulfates. An ether extraction of the uranyl nitrate is then performed in a cellulose column as described in CRL Report AE19. The ether in the extract is distilled off and the uranium remaining can be determined: (1) colorimetrically by NaOH and hydrogen peroxide; (2) volumetrically by use of a Jones reductor and dichromate; (3) gravimetrically as the oxine precipitate; or (4) fluorimetrically. With many ores it is necessary to eliminate arsenic before the column extraction as otherwise the recovery of uranium is not quantitative. Hydrobromic acid with hydrochloric acid and hydrazine hydrochloride are considered more suitable for eliminating arsenic than hydrogen sulfide since the separation can be accomplished by heating in the original beaker without a filtration. However a minimum amount of HBr should be used to avoid losses through spattering on evaporation. Sulfates are removed largely by precipitation with carbonate free ammonium hydroxide and re-solution in nitric acid. If phosphates are present they can be complexed by iron. If insufficient iron is present in the sample, more is added as ferric nitrate solution.

5226 Radioactivity and Mineralization in Rhyolite Porphyry. Paul E. Damon. Geophysics 15, 94-101(1950) Jan.

Measurements of the hard γ radiation from the pre-Cambrian rhyolite porphyry of a Bourbon, Missouri, well core show a direct relationship between mineralization and radioactive content. Low activities are, in general, associated with high mineral density, the latter being a function of the magnetite content. The low activities are most probably due to a leaching out of the potassium content. This indicates that γ-ray well logs should be capable of accurately

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measuring the location of mineral deposits in potassium-rich rock.

5227 Studies of Uranium Minerals (III): Saleeite from Schneeberg, Saxony. Mary E. Morse. Am. Mineral. 35, 525-35(1950) July-Aug.

Saleeite from Schneeberg, Saxony, has the composition $Mg(UO_2)_2(P,AsO_4)_2 \cdot 10H_2O$, with P:As = 84.4:18.8, and is isostructural with fully hydrated artificial autunite, $Ca(UO_2)_2(PO_4)_2 \cdot 10H_2O$. Crystals are flat tablets on (001) with (010) and (012) and are found by x-ray and optical study to be tetragonal. The unit cell dimensions are a_0 = 6.890 A, c_0 = 19.813 ($a_0:c_0$ = 1:2.839; a:c = 1:2.840 morphology), with the space group, if holohedral, 14/mmm. The calculated and measured specific gravity is 3.27. Its color is yellow to lemon-yellow. The plane of perfect cleavage is (001). It is optically uniaxially negative with nO 1.574 (pale yellow), nE 1.559 (nearly colorless). The original saleeite from Katanga has the composition $Mg(UO_2)_2(PO_4)_2 \cdot 8H_2O$ and appears from the available evidence to be a lower hydrate that is isostructural with meta-autunite-I. (auth)

5228 Studies of Uranium Minerals (IV): Johannite. Cornelius S. Hurlbut Jr. Am. Mineral. 35, 531-5(1950) July-Aug.

X-ray Weissenberg study of johannite gave the following characteristics for the triclinic face-centered cell corresponding to the pseudo-monoclinic morphological cell of Peacock (Zeit. Krist. 90, 112(1935)): (1) a_0 = 16.51 kX, b_0 = 17.98, c_0 = 6.83 with $\alpha = 90°54'$, $\beta = 90°38'$, $\gamma = 110°37'$ (from morphology). (2) Cell contents $Cu_4U_8(SO_4)_8(OH)_{40} \cdot 8H_2O$. (3) Specific gravity 3.32 (meas), 3.27 (calc). (4) Transformation, face-centered to primitive triclinic cell: $\frac{1}{2}0\frac{1}{2}/0\frac{1}{2}\frac{1}{2}/001$. (5) Elements of the primitive cell: $a_0:b_0:c_0$ = 0.9382:1:0.7143, $\alpha = 108°50'$, $\beta = 112°3'$, $\gamma = 64°52$ (auth)

5229 Uranium Minerals of India. N. R. Srinivasan. Current Sci. 19, 141-2(1950) May.

The various uranium minerals are listed and a brief remark is made as to the occurrence of each in India. A note on page 145 of the same issue announces rewards by the Indian Government for discoveries of uranium and beryllium.

5230 Use of a High-pressure Ionization Chamber in Assaying Uncrushed Ore Samples. J. L. Horwood and C. McMahon. Department of Mines and Technical Surveys (Canada) Memorandum Series No. 106, Jan. 1950. 18p. (AEC File No. NP-1528.)

The ionization chamber used is type T.P.J. (CRTec-276). It has a collecting volume of 996 cc enclosed in a cylinder 20 cm long. Argon is used as the filling gas. The apparatus has been in use daily for 12 months with consistent results. Over a period of one month the average variation in sensitivity was 0.5%, the greatest departure being less than 2%. Operation of the apparatus is described, and some routine analytical results are compared with those from G-M counter and chemical analysis results. Two systems of measurement are used: (1) deflection method, for use with very strong samples or where a continuous record of the sensitivity of the apparatus is required; (2) charge time method, for rapid screening of samples or where the sample is very weak.

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5231 Physics Division Quarterly Progress Report for Period Ending March 15, 1950. A. H. Snell and E. O. Wollan. ORNL-694, June 13, 1950. 77p.

Scintillation Spectrometry. Following publication of results on K^{40}, attention is now being turned to Rb^{87}. An improvement in the resolution of the instrument has been made. Monoenergetic electrons have been used to test the linearity of the pulse height vs electron energy response; excellent linearity has been found in the range 0.12 to 3.2 Mev. The 2.5-sec erbium isomer is found to have a γ ray of 185 kev, which is partially internally converted. Short-Lived Isomers. An interesting observation is made relative to the occurrence of the short- and long-lived isomers in the heavy group (N or Z = 63 to 81). In this group, isomers in which the odd particle is a neutron are found almost entirely to have long decay periods (seconds to days), whereas if the odd particle is a proton, the decay periods are short (microseconds or less). Physical Electronics. A single channel differential pulse height selector has been designed, using an anti-coincidence circuit to prevent registration of pulses larger than those in the desired interval. A ten-channel differential pulse height analyzer also has been designed, which employs twelve 6BN6 discriminator tubes. The first grids of these tubes are biased 5 volts apart, so that arrival of a pulse of given size will prepare some of the tubes to conduct. A sweep generator then applies rising voltage to the third grids of the tubes, likewise biased 5 volts apart, until the first tube is reached which has already been prepared to pass plate current. When this tube conducts, the process is stopped, a count is registered on the appropriate scaler, and the circuit is reset. Neutron Cross Section of Holmium. Preliminary results with the crystal spectrometer indicate that holmium may have an unusually large scattering cross section at .03 ev. Neutron Diffraction. Angular distribution studies of the neutron scattering by unmagnetized Co have succeeded in separating the magnetic scattering from the nuclear scattering. The magnetic scattering amplitude is found to be slightly greater than the nuclear scattering amplitude; this suggests that a very high degree of neutron polarization might be achieved by Bragg reflection from magnetized cobalt. New results have been obtained on the coherent scattering cross sections of the nickel and calcium isotopes. Ni^{62} scatters with "negative" phase; all others are "positive." Neutron Decay. A set of coincidence data is presented which seems to demonstrate beyond reasonable experimental doubt that neutrons do indeed undergo radioactive decay. Low Temperatures. The following elements were found to become superconducting at the indicated temperatures: Zr, 0.603°K; Ga, 1.11°K; Cd, 0.542°K. Results on Th (1.71°K) and Y (no superconductivity above 0.15°K) are not considered final because of possible impurities. Irradiation of Semiconductors. Examination of the values of the minimum conductivity of germanium samples exposed to pile radiation indicates that about 3 acceptor states are produced per incident fast neutron. This is in reasonable agreement with the number (6 per incident neutron) of atomic displacements to be expected to be produced as the result of scattering of fast neutrons in the Ge sample. Irradiation of Ge changes it from an N- to a P-type semiconductor. Two mechanisms are involved: (1) formation of lattice displacements; (2) formation of impurity centers by transmutation following slow neutron capture. The former effect can be annealed out. The effect which remains is now shown to be quantitatively accounted for from the flux data, provided one uses the latest Ge capture cross section values,

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and therefore it can be completely understood as a result of transmutations. Radiation Damage. Electron bombardment of water-cooled Be-Cu in the Van de Graaff machine has produced a 3% increase in electrical resistance. This effect is being examined closely to see whether it is a true "radiation damage" effect. High Voltage Program. A radiofrequency ion source has been constructed which gives a H_1^+/H_2^+ ratio of two, and delivers 30 μa of protons with the rather low gas consumption of 8 cc (atmospheric pressure) per hr.

5232 Physics Division Quarterly Report: February, March, and April, 1950. UCRL-759, June 20, 1950. 43p.

Research on the following subjects is reported: cloud chamber program; film program; the neutral meson program on the 184-in. cyclotron; magnetic particle spectrometer; development of proportional counters for fast neutron surveys; variation of total cross sections of nuclei with neutron energy; hi-speed oscilloscope; proton-proton scattering; deuteron-proton scattering; a measurement of the positive π-μ decay lifetime; production of neutral mesons in the synchrotron beam; proton-proton scattering as a function of energy; inelastic scattering; observation of fast neutrons produced by π^- capture; analysis of photographic plates exposed to mesons from proton-proton collisions; capture of negative π mesons in hydrogen; meson production; synchrotron studies; theoretical physics; 184-in. cyclotron; 60-in. cyclotron; synchrotron; linear accelerator and Van de Graaff machines; bevatron development.

5233 Cataphoretic Deposition of Boron. O. Flint. Atomic Energy Research Establishment Report AERE-M/R-355, nd. 4p.

An electrolytic method which yields adherent, hard deposits of boron, up to 3 mm thick, in 15 min, by the electrolysis of a suspension of amorphous boron in methyl alcohol is described. These cataphoretic deposits are not improved by any thermal treatment. It is concluded that the deposition of boron by cataphoresis provides a rapid, safe method for the production of boron films for use in neutron flux counters. (auth)

5234 Damage from Atomic Explosion and Design of Protective Structures. Washington, National Security Resources Board, 1950. 32p.

This report assesses, in general terms, certain effects of atomic weapons. It deals particularly with the damage an air blast would cause to various types of structures and buildings, and with building construction to resist these effects.

5235 Electrical Resistance of Thoria. W. E. Danforth and F. H. Morgan. Phys. Rev. 79, 142-4(1950) July 1.

Measurements of the electrical conductivity of thoria (ThO_2) were taken in vacuum at temperatures up to 2073°K. Activation by passage of current resulted in values of resistance as low as 1 ohm-cm at 1900°K and 10 ohm-cm at 1000°K. Activation energies between 3.2 volts and 0.58 volt were found. The density of impurity centers was computed as 10^{18} per cc and was found to be independent of the degree of activation by current, a result which is inconsistent with the hypothesis of the electrolytic origin of impurity centers. (auth)

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5236 Electron Physics Research at Birmingham University. G. F. Hull, Jr. Office of Naval Research, London Branch, Report No. OANAR-4-50, Jan. 9, 1950. 5p.

J. Sayers, Professor of Electron Physics at the University of Birmingham, is engaged with his students and colleagues on a number of projects which are as follows: the measurement of the impedance of a pulsed gaseous discharge when in a magnetic field, the measurement of electron densities in glow discharges by microwave techniques for comparison with similar measurements made by Langmuir probe techniques, pulse electron microscope lenses, recombination cross section for ions and electrons by means of pulse and microwave techniques, and pulsed dielectric breakdown in pure organic liquids. (auth)

5237 Low Temperature and Ultrasonic Research at Louvain. Paul M. Marcus. Office of the Naval Attache, London, Technical Report No. ONRL-45-50, Apr. 14, 1950. 14p.

A description is given of the facilities, staff, and research problems under investigation at the Institute for Low Temperature Physics of the University of Louvain, Belgium. This laboratory, which has been engaged for several years on a small number of low temperature researches is now in the process of reconstruction and general expansion of its facilities. New buildings and new equipment, such as a large magnet for adiabatic demagnetization work, are being acquired. There is a moderate sized liquid air plant, a small hydrogen liquefier, and two small helium liquefiers of the expansion type. A Philips electron microscope has just been purchased for studies of thin film structure. Extensive measurements have been made of the resistance of thin metal films deposited on glass by sputtering as a function of temperature, thickness, and manner of deposition. Particular attention is being paid to the existence of a minimum in the resistivity-temperature curve for films which are thin enough. An explanation of the "semiconducting" region below the minimum in terms of cracks in the film is being studied. Low temperature thermometers are being developed which make use of the change of resistance of nickel films. Measurements of the velocity of sound in liquids at low temperatures by the acoustical interferometer are in progress. In particular the conversion of ortho to para hydrogen is being studied by observing the accompanying small increase in velocity as a function of time. The pressure balance method is being applied to measurements of the absorption of ultrasonics in water and water solutions. At Leiden the thermal diffusion of a mixture of various gases at low temperatures is being studied, and the viscosity of liquid helium through the λ point is being measured. An appendix contains a list of publications of the laboratory. (auth)

5238 Photo-Mesons from Carbon. Jack Milton Peterson. UCRL-703, May 17, 1950. 57p.

The experiment reported here was designed to display the angular and energy spectrum of mesons produced in carbon by x-rays generated by 322-Mev electrons. Nuclear emulsion plates were used for meson detection and for determination of the minus-plus ratio, the energy spectra and cross sections, and the angular distribution of the emitted mesons. 21 references.

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5239 Production of Mesons by Photons and Nucleons. Keith Allan Brueckner. UCRL-715, nd. 69p.

It is shown that the results of the calculation of meson production by photons depend very markedly on the nature of the coupling of the mesons to the electromagnetic field. Since processes involving such coupling can be handled very well for nonrelativistic energies by treating the interactions as weak, the usual methods of perturbation theory can be applied with some confidence to this aspect of the production process. The uncertainties of the nature of the coupling of mesons to nucleons which lead to incorrect prediction of scattering phenomena, do not strongly affect this process. In fact, the very characteristic differences between the behavior of the photon-ejected spin zero and spin 1 mesons are shown to be due almost entirely to the nature of the meson coupling to the electromagnetic field. It has further been thought worthwhile to carry out the calculations using the new covariant formalism, eliminating unnecessary approximations and exhibiting the simplicity of the methods. Finally, the higher order corrections in the meson-nucleon interaction have been calculated for the pseudoscalar theory, using the new subtraction techniques, and found to give finite and unambiguous results. For meson production by nucleon-nucleon interaction the calculation has been made of the transition matrix elements on the basis of rigorous third order perturbation theory, and the expressions for scalar theory, pseudoscalar theory with pseudoscalar and pseudovector coupling, and vector theory with vector coupling have been obtained. The calculations are made in the center-of-mass system for energies near threshold where the velocities of the final particles are small. Corrections of the order of v^2/c^2 for the final nucleons and meson are neglected, so the results are only applicable for incident nucleon energies of 350 to 400 Mev corresponding to maximum meson energies in the center-of-mass system of 23 to 44 Mev.

5240 Altitude Dependence of Neutron Production by Cosmic-Ray Particles. W. B. Fowler. Phys. Rev. 79, 178-9(1950) July 1 (Letter to the editor).

Counter telescope measurements at Climax, Colorado (3400 m) and St. Louis, Missouri (170 m) are compared. A Pb filter was placed above the telescope, a Pb absorber below, and thermal neutron counters were imbedded in paraffin below the absorber. The neutrons in delayed coincidence with apparent stoppings in the absorber were 6.0 ± 0.6 times as numerous at the higher altitude, and those in delayed coincidence with apparent penetrations were 16.3 ± 1.2 times as numerous. Of the particles stopped in lead, 75% at the lower and 35% at the higher altitude seemed to be μ^--mesons.

5241 Conference on Elementary Particles; Edinburgh, November 14-16, 1949. Paul M. Marcus. Office of Naval Research, London Branch, Technical Report No. OANAR-11-50, Jan. 18, 1950. 14p.

About 100 European physicists attended the Conference on Elementary Particle Theory at Edinburgh, November 14-16, 1949, organized by the Department of Natural Philosophy of the University. A program of 15 papers discussed recent experimental work on cosmic ray particles observed with photographic plates including studies of nuclear explosions and the particles emerging from them, measurements of the ratio of + to −mesons at sea level as a function of particle momentum, evidence for the nature of the μ meson

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decay, and attempts to observe the negative proton and dineutrons. Among the theoretical papers were discussions of the postulate of reciprocity in quantum field theories and its application to electrodyamics, Pauli's "regularization" process in quantum electrodynamics, a suggested mechanical explanation of the origin of cosmic rays, and the plural hypothesis for production of mesons. This was an informal conference, partly organized in honor of Professor Niels Bohr, and no proceedings will be issued. A number of the papers presented are summarized in this report. (auth)

5242 Cosmic Radiation. N. Y., Interscience Publishers, Inc., 1949. 189p.

This volume presents the final considered versions of 29 papers contributed to the Symposium on Cosmic Radiation held in September 1948 at the University of Bristol. While predominantly experimental, covering the subjects of primary radiation, nuclear explosions, light and heavy mesons, and penetrating showers, the reports include the then present state of cosmic ray and meson theory in papers by Drs. W. Heitler, L. Rosenfeld, C. Møller, and R. Fürth.

5243 Cosmic Ray Intensity in the Upper Atmosphere. M. Panetti and G. Wataghin. Phys. Rev. 79, 177-8(1950) July 1. (Letter to the editor).

The observed variation of cosmic-ray intensity with depth in the upper atmosphere is shown to correspond with a formula, the derivation of which is given.

5244 Further Investigations on the Plural Production of Meson Showers. W. Heitler and L. Jánossy. Helv. Phys. Acta 23, No. 4, 417-31(1950).

Calculations on the size of nucleon initiated meson showers have been extended by including secondary effects of recoil nucleons. It is shown that showers with up to 30 or 40 mesons occur still with reasonable probability in the picture of plural production. The protons accompanying the shower and the angular distribution are discussed. The production of showers by π mesons is considered. Assuming that these showers are primarily due to the scattering of the meson by a nucleon, it is shown that for high meson energies meson showers are produced. The cross section is estimated to be 0.4 - 0.9 of the geometrical cross section for heavy elements at the most important energies. It is found that all the conspicuous features of penetrating showers can be understood by the picture of plural production.

5245 International Congress on Cosmic Radiation, Como, Italy. T. Coor. Office of Naval Research, London Branch, Technical Report No. OANAR-1-50, Jan. 5, 1950. 14p.

An International Congress on Cosmic Radiation, sponsored jointly by the Italian Physical Society and the International Union of Physics, was held in Como, Italy, September 11-16, 1949. Papers on all aspects of cosmic radiation were presented, particularly on results obtained using photographic emulsion techniques. The main question raised at the Congress was whether meson production at a nucleon-nucleon interaction is multiple or plural. No definite conclusion was reached. Abstracts of some of the more important papers presented are given. (auth)

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5246 Local Showers in Air and Internal Explosions. Roland Maze. J. phys. radium 11, 294-9(1950) June (in French).

In spite of certain appearances, the arrangements of isolated counters in lead do not register local penetrating air showers. The effects observed are due to bursts produced in matter and can have a large internal extension. The exterior density is closely confined to the apparatus and does not arise from air but from matter. The average path in air and lead of the primary particles, and the variation of these factors as a function of the required density are found. 17 references. (auth)

5247 Measurements of the Mass of Cosmic Ray Particles at an Altitude of 3650 Meters. E. Bastin, J. Becker, P. Chanson, E. Nageotte, and P. Treille. J. phys. radium 11, 273-83(1950) June (in French).

Experiments were performed to show the existence of cosmic ray particles with a mass intermediate between that of a π meson and a proton. The mass of a particle can be deduced from its momentum and its residual path. The method uses a Wilson cloud chamber immersed in a magnetic field to measure the momentum. Counters were used to estimate the residual path of the particles in a copper plate placed below the cloud chamber. Results indicate that there could not be, between the π meson and the proton and especially between the masses 500 and 1100, ionizing particles having at an altitude of 3650 m a momentum between 200 and 550 $\frac{\text{Mev}}{\text{C}}$, whose half-life exceeds 10^{-6} sec, and whose intensity is greater than 5×10^{-5} (ster sec cm^2)$^{-1}$. 14 references. (auth)

5248 Note on Very Large Cosmic-Ray Stars. Yoichi Fujimoto and Yoshio Yamaguchi. Prog. Theor. Phys. (Japan) 5, 76-81(1950) Jan.-Feb. (See also NSA 3-725.)

The α particles emitted in high energy nuclear reactions seem to contradict the evaporation theory both as to their energy distribution and their angular collimation. The authors examine the two possible explanations, (1) local heating and (2) fission with disintegration of the smaller fragment into α particles, and find that the latter seems to explain the facts if it is also true that the nuclear surface tension decreases with increasing excitation energy.

5249 The Observability of the C-Meson. Syûzô Ogawa. Prog. Theor. Phys. (Japan) 5, 72-5(1950) Jan.-Feb.

The existence of the C-meson is discussed. To explain the cosmic-ray absorption curves which are obtained underground, the C-meson is believed to have a mass of ~500 m.

5250 On the Azimuthal Asymmetry of Cosmic-Ray Intensity above the Atmosphere at the Geomagnetic Equator. J. A. Van Allen and A. V. Gangnes. Phys. Rev. 79, 51-3(1950) July 1.

By means of G-M tube telescopes in an Aerobee sounding rocket fired to high altitude at the geomagnetic equator, information on the azimuthal asymmetry of the cosmic-ray intensity above the atmosphere has been obtained. These results, in conjunction with previously reported vertical intensities and specific ionizations at $\lambda = 0°$ and $\lambda = 41°$N, are consistent with the hypothesis that most of the primaries

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are positively charged protons with differential number spectrum of the form $dN = KE^{-1.9}\,dE$ in the energy region 5 to 23 Bev. (auth)

5251 The Production of Coherent Penetrating Particles in the Atmosphere. J. Clay and E. Van Alphen. Physica 16, 393-6(1950) Apr.

By coincidence measurements at sea level and at 3040 and 7000 m, meson production was found to vary with altitude as it would if protons were the primary particles and were absorbed in the atmosphere.

5252 Varytrons. J. Daudin. J. Phys. radium 11, 25D-29D(1950) June (Exposes, in French).

The work of Alichanian and Alichanov (Zhur. Ekstl. i Teoret. Fiz. S.S.S.R. 18, No. 3, 301(1948) and No. 8, 673 (1948)) is discussed. Observing a continuous momentum spectrum for particles of definite path, these authors deduced that particles exist with a mass between 200 and 2000 times the electron mass and of a greater intensity, in contradiction with other known observations. This disagreement seems to stem from inherent faults in the principle of the experimental method with insufficient attention given to statistical errors and an underestimation of the role of electrons and photons. For the hard component and for protons, the results seem worthwhile. (auth)

5253 Rise Times of Voltage Pulses from Photomultipliers. O. Martinson, P. Isaacs, H. Brown, and L. W. Ruderman. CUD-50, Apr. 14, 1950. 6p.

A method has been devised for measuring fast rise times of voltage pulses from photomultiplier tubes without using high-speed oscillographs. Plots of the rise of the pulses have been made for pulses from various organic phosphors, and for noise pulses (using both thermionically emitted electrons and those knocked out of the photo-cathode gamma-rays. These results show fair agreement with those of other investigators.

5254 Characteristics and Behavior of Bonded Wire Resistance Strain Gages in Thermal Coefficient of Expansion Measurements. Part II. SR-4 Bakelite Bonded Dual Lead Gages. Martin R. Goodman. ORNL-707, June 13, 1950. 17p. (See also NSA 4-4324.)

Dual lead type bonded wire strain gauges appear to have no significant advantage over other types of bonded wire strain gauges except for less inherent gauge creep. The literature indicates that ceramic bonded wire strain gauges have been used at temperatures as high as 800°C. These gauges exhibit properties similar to paper and bakelite bonded strain gauges. Bonded wire resistance strain gauges of any type are appropriate for application to many problems. Where extreme accuracy is desirable it is important to be thoroughly familiar with the characteristics and behavior of these gauges. (auth)

5255 High Voltage Stabilization by Means of the Corona Discharge between Coaxial Cylinders. S. W. Lichtman. Naval Research Laboratory Report No. NRL-3635, Mar. 13, 1950. 14p.

The corona discharge between coaxial cylinders affords a practical means for stabilizing high voltages in a manner analogous to the stabilization of low voltages by the familiar

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glow-tube regulator. The corona regulator is particularly suitable for stabilizing voltages above several hundred volts at currents below 1 ma. It is accordingly well adapted for controlling the beam focusing and accelerating potentials of cathode-ray beam devices such as oscilloscope, iconoscope, and kinescope tubes, of electron diffraction cameras, and for stabilizing Geiger tube voltage sources. Some of the theoretical aspects of the corona discharge region as related to voltage stabilization are reviewed. Circuit design relationships are considered in detail and are developed to an extent sufficient for adapting particular corona regulator tube characteristics to specific performance requirements. Examples of constructional features and performance characteristics of typical high-voltage regulating tubes are presented. 12 references. (auth)

5256 Notes on Frequency Compensation in D. C. Coupling Circuits. C. D. Florida. Atomic Energy Research Establishment Report No. AERE-EL/R-456, Dec. 14, 1949. 18p.

Four compensating circuits (one of which is new), for use with resistive intervalve couplings, are described and the errors caused by component variations are analyzed and discussed. It is shown that the new circuit can be made substantially free from error due to component variations for all times greater than about 0.1 μsec. (auth)

5257 A Simple Apparatus for the Dilution of Radioactive Barium Carbonate. B. G. van den Bos and A. H. W. Aten, Jr. Chem. Weekblad 46e, 424-5(1950) June 17. (in Dutch).

A method and apparatus are described for the dilution of radioactive barium carbonate in substantial quantities. The active and inactive carbonate, the former contained in a small boat of folded platinum foil, are placed in a 250 ml flask. The apparatus is evacuated through a dropping funnel and HCl, 1N, is added to liberate CO_2. As soon as the carbonate is dissolved, a slight excess of barium hydroxide solution is added. To effect complete absorption, the apparatus is shaken until the pressure becomes constant. Finally an excess of NH_4Cl is added and air is admitted. The carbonate is filtered off in the usual manner.

5258 The Gas Phase Exchange Reaction Between HBr and Br_2. Homer Jacobson. AECU-862, nd. 3p.

This is not an abstract; the document is reproduced below in its entirety.

The exchange reaction between gaseous HBr and Br_2 is known from previous investigations (Brejneva, et al, Acta Physiochemica (U.R.S.S.) 5, 549(1936); L. Liberatore and J. Wiig, J. Chem. Phys. 8, 168(1940); W. F. Libby, ibid, 8, 348(1940)) to be rapid, being reported as almost complete within 2 min at room temperature with approximately equivalent amounts of reactants at a total pressure of about 100 mm (ibid). We have studied the reaction with a dynamic mixing and separation procedure in which the contact time was of the order of 0.5 sec and the total pressure about 1 mm, with approximately equivalent amounts of the reactants. The reaction is found to be complete within a few seconds, and estimates of its half time have been obtained.

Using Br_2 tagged with Br^{82}, the extent of reaction was determined by measuring the specific activities of the Br_2 and HBr subsequent to mixing and separation. The reactants were passed through individual flowmeters and throttling valves into a mixing tube, where the exchange took place. The mixture then passed into two traps in tandem, the first held at −120°C (with a slush of partially frozen n-butyl chloride) trapping out the Br_2, from HBr was shown to be quantitative by chemical analysis of the trapped materials. After a sufficient amount of the gases had been collected, the traps were removed from the line, and the gases dissolved in ammonia water, from which the bromine was precipitated as AgBr. Reproducible counting of precipitates up to 60 mg/cm² in thickness was obtained, provided the precipitation was performed in 1 M NH_3, and the solution was filtered immediately. The Br_2 used was tagged with Br^{82} by repeated gas phase exchange with anhydrous $AlBr_3$, in which pile irradiated KBr had been dissolved. Chlorofluorocarbon oils and greases were used in the apparatus throughout to minimize reaction with bromine.

The data obtained in 22 runs can be summarized as follows. In a preliminary run it was shown that no exchange took place between HBr (g) and Br_2 (s) in the −120° trap. With 12 sec contact time at 23 mm 98% exchange took place. In 18 runs at room temperature (18 to 24°C), pressures 0.5 to 2.0 mm, and contact times of 0.4 to 0.9 sec, half-times of exchange of 0.14 to 0.75 sec were observed. In two runs at 21 and 18°, 1.1 mm pressure, and 0.5 sec contact time, with the mixing chamber loosely packed with SiO_2 wool, half-times of 0.06 and 0.08 sec were observed. The increased rate suggests a heterogeneous reaction, which is consistent with a certain amount of irreproducibility found in the other data. This irreproducibility obscured any systematic trend of half time with temperature or pressure. Runs at activity levels of 10^{-3} to 3×10^{-6} μ/cc showed that the exchange is not caused primarily by radiation activation. Several of the runs were done in total darkness, with no indication of a photochemical effect in the others. The reaction is believed not to have been diffusion controlled. Calculation indicated that the gases had mixed completely within the first 5% of their stay in the mixing chamber, in which time the mean diffusion path length of the gases was about twice the mixing chamber diameter.

We believe it likely that the reaction proceeds in a heterogeneous fashion on the walls of the vessel, as in the case of the Br_2-C_2H_4 reaction (Stewart and Edlund, J. Am. Chem. Soc. 45, 1014(1923); Norrish, J. Chem. Soc. 55(1926)), a conclusion differing from that of Libby and Dodgen (J. Chem. Phys. 17, 951(1949)).

5259 Thermodynamics of Irreversible Processes. Paul M. Marcus. Office of Naval Research, London, Technical Report No. ONRL-33-50, Mar. 22, 1950. 15p.

An informal two-day conference on the subject of Thermodynamics of Irreversible Processes was held on January 5 and 6, 1950, at the Butterwick Research Laboratories of Imperial Chemical Industries in Welwyn. Among the half dozen talks were discussions of theoretical and experimental aspects of thermal diffusion in liquids and gases, and thermo-osmosis in membranes, remarks on the theory of the steady state, and a review of theoretical work in irreversible thermodynamics. Two interesting matters brought up at the meeting concerned a possible improvement in the separation of He^3 from He^4 with a thermal diffusion column and the optical technique for measurement of thermal diffusion in liquids applied by C. C. Tanner in 1927.

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5260 Winter Meeting of the Swiss Chemical Society, March 5, 1950, Basel, Switzerland. R. W. Helmkamp. Office of Naval Research, London, Technical Report No. ONRL-46-50, Apr. 13, 1950. 5p.

This report contains brief comments on the papers presented at the Winter Meeting of the Swiss Chemical Society on the preparation of pure heavy nitrogen, the preparation of $Ga^{35}Cl_3$, and the structure of eleutherol. (auth)

5261 Nuclear Multiple Plate Camera. J. C. Allred, L. Rosen, F. K. Tallmadge, and J. H. Williams. LA-1088, May 8, 1950. 19p.

A new technique for utilizing nuclear emulsions as charged particle detectors in nuclear cross section experiments is described. Its principle advantage is that the solid angle measurement is essentially independent of the angle which the plate makes with the slit axis. The design of a multiple plate camera incorporating this feature is described in this report. Observations can be made in the angular region from 10 to 170 deg (in laboratory coordinates) at intervals of 2.5 deg. Slots are provided for the insertion of absorber foils in front of the plates. Two experiments (p-p and p-He^4) where accurate values had previously been obtained, were performed to check the accuracy of the camera. Results were in good agreement.

5262 Neutron Energy Spectrometer. B. R. Gossick and K. Henry. ORNL-711, June 12, 1950. 13p.

A proportional counter has been designed which gives the neutron energy distribution without taking derivatives of the counting rate. By virtue of biasing a linear pulse amplifier to take advantage of the peak in the Bragg specific ionization curve, only these recoils from a polystyrene radiator are counted which traverse a given thickness of stopping material through a collimator and then end their path near a short anode. Thus the range is associated directly with the number of counts. The counter was filled with 9 cm Hg of argon and 1 cm Hg of CO_2.

5263 The Application of Proportional Scintillation Gamma-Ray Counters to the Determination of Radioactive Decay Schemes. P. E. Cavanagh. Atomic Energy Research Establishment Report AERE-NR-488, Feb. 1950. 12p.

It is shown that a scintillation counter can be used as a γ-ray spectrometer of rather poor resolution but very high efficiency. As an example of its application to the determination of radioactive decay schemes it has been used to separate the high energy rays of I^{131} from the main low energy γ-ray group. Coincidences between the separated high energy γ rays and β rays recorded by means of a proportional counter were measured as a function of absorber placed before the β-ray counter; 4,000 coincidences were recorded for each value of absorber, and the genuine coincidence rate followed down a factor of 100. A comparison with the absorption curve for the β rays of Co^{60} measured in the same geometry gives the maximum energy of the low energy β-group in coincidence with the high energy γ rays of I^{131} as 315 kev. (auth)

5264 Automatic Registering of Geiger-Mueller Counter Plateaus. R. Wahl. J. phys. radium 11, 271-2 (1950) June (in French)

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Consecutive curves of the plateaus of 10 Geiger-Mueller counters arranged in a circular array are automatically made up by an integrating recorder and a special contact whose rotation is synchronized with that of the recorder. (auth)

5265 Crystal Counters. Robert Hofstadter. Proc. I.R.E. 38, 726-40(1950) July.

This article is a review of the developments in the new field of conduction type crystal counters. The topics included are: the nature of the phenomenon from the theoretical aspect, the preparation and growing of crystals, a discussion of properties of certain useful crystals (diamond, ZnS, CdS, sulfur, silver, and thallium halides, argon, and germanium), the efficiency, and useful lifetime of crystals. The major properties of most of the crystals mentioned are summarized at the end of the article. 67 references.

5266 The Design of Neutron Counters Using Multiple Detecting Layers. R. D. Lowde. Atomic Energy Research Establishment Report AERE-GR-493, May 1950. 22p.

A discussion is given of ion chambers in which a series of electrodes carry layers of solid detecting material. Counters of this type require low operating voltages, and can easily be miniaturized. Formulas are given for the correction layer thicknesses and for the neutron counting efficiency. The equations are applied to boron 10, and it is shown that there is a permissible tolerance of about 50% on the thickness of a boron layer, and a very considerable tolerance on the assumed values of the disintegration product ranges. Curves are given relating the optimum boron layer thicknesses and the efficiency to the number of layers. A miniature instrument is described having a sensitive volume of 0.4 cm^3. It operated at a thermal neutron efficiency of 24% with a collecting voltage of 70. (auth)

5267 Fluorescence of Liquids under Gamma Bombardment. Hartmut Kallman and Milton Furst. Nucleonics 7, No. 1, 69-71(1950) July.

Liquid scintillation counters, with no size limitations, could supplement hard-to-grow crystals in cosmic-ray and other nuclear research. New results are reported on the light efficiency of several solutions. Absorption of the fluorescent light in the solutions themselves represents a very important loss in efficiency, absorption coefficients as small as 10^{-1} to 10^{-2} per cm having considerable effect. It was found that very small amounts of contamination of the order of 0.01 to 0.001 gm/l can be harmful in this respect, probably by absorbing the light and failing to re-emit it.

5268 Geiger Counters with Xenon-Oxygen Filling. Von Oswald Riedel. J. Naturforsch. 5a, 331-2 (1950) June.

A weak discharge through a mixture of xenon and oxygen produces a green band spectrum, presumably due to resonance transfer from oxygen ions to metastable xenon atoms. The author has utilized this phenomenon as a self-quenching feature in counters, obtaining good constancy and stability.

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5269 Identification of Nitrogen Photo-Disintegration Stars in Nuclear Emulsions. J. J. Wilkins and F. K. Goward. Proc. Phys. Soc. (London) 63, 663-5(1950) June 1 (Letter to the editor).

Stars are allocated to an appropriate energetically possible reaction and a plot is made of number of stars versus $|\Delta|$, where $|\Delta|$ is defined in Abstract 4-5270 below. The appearance of a peak in the plot confirms the allocation and stars not contributing to the peak are reconsidered as a different reaction with new $|\Delta|$ values. The assignment of a new reaction $N^{14} + h\nu \rightarrow Li^6 + 2He^4 - 16.1$ Mev to 6 three-particle stars is discussed as an example of the method.

5270 Identification of Photo-Disintegration Stars in Nuclear Emulsions. F. K. Goward and J. J. Wilkins. Proc. Phys. Soc. (London) 63, 662-3(1950) June 1 (Letter to the editor).

If the identities of the particles of a photodisintegration star are known, the particle energies E_r ($r = 1,2...$) in Mev, and the momenta, p_r, in units of (Mev × mass number)$^{1/2}$ may be determined. The momentum, p_γ, of the gamma ray is $(E_T + E_0)/43.1$, where $E_T = \Sigma E_r$ and E_0 is the threshold of the reaction, so that, for conservation of momentum $\Delta = (\Sigma p_r) - p_\gamma = 0$. Thus $|\Delta|$ is a convenient measure of the overall accuracy. Accuracy of the individual experimenter, in the identification of star particles, is held to be a matter of cultivation, different results by trained and untrained observers being illustrated by sample curves of number of stars versus $|\Delta|$.

5271 Mechanism of the Geiger Discharge. Sven Werner. Nature 165, 1018-19(1950) June 24 (Letter to the editor).

It is held that secondary ionization in the Geiger discharge by positive ions, rather than by photoelectrons from the cathode, best explains the observed values of starting voltage and that many other hitherto unexplained properties of the discharge can be accounted for.

5272 A Molecular Beam Resonance Method with Separated Oscillating Fields. Norman F. Ramsey. Phys. Rev. 78, 695-9(1950) June 15.

A new molecular beam resonance method using separated oscillating fields at the incident and emergent ends of the homogeneous field region is theoretically investigated in this paper. An expression is obtained for the quantum mechanical transition probability of a system between two states when the system is subjected to such separated oscillating fields. This is numerically averaged over the molecular velocity distribution and provides the theoretical shape of the resonance curves. It is found that resonances with such a technique have a theoretical half-width only 0.6 as great as those by conventional molecular beam resonance methods. In addition to producing sharper resonance minima, the new method has its resonances much less broadened by inhomogeneities of the fixed field, it makes possible resonance experiments in regions into which an oscillating field cannot be introduced, and it is more convenient and effective with short wavelength radiation. (auth)

5273 A New Process for Preparing "Sandwich" Emulsions for Nuclear Physics. Advantages over the Method of Impregnation. L. Vigneron and M. Bogaardt. J. phys. radium 11, 283-87(1950) June (in French).

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The element studied is introduced in the form of a gelatinous suspension of microscopic grains of an insoluble compound, between 2 layers of emulsion perfectly joined, at a temperature of 45°. This process avoids chemical deterioration and pH change of the emulsion. The origin of the tracks, using fission as an example, is defined without ambiguity. The nuclear reactions of the substance studied are not masked by those of the elements comprising the emulsion. The amounts introduced are hardly less than are introduced in impregnating a solution of a soluble compound. (auth)

5274 Nuclear Resonance and Magnetic Field Changes of 1 in 10^6. J. S. Gooden. Nature 165, 1014-15(1950) June 24 (Letter to the editor).

A new method has been developed for measuring relaxation times in the presence of an inhomogeneous magnetic field. A solution of ferric ammonium sulfate, very dilute so that relaxation times were ≥ 0.01 sec, was used and the field of 1,060 gauss was modulated at 50 cps by an amplitude of >10 gauss. The nuclei continued precessing after resonance was passed, the frequency increasing with the magnetic field and beating with the exciting r-f to produce "wiggles" in the signal. Very small abrupt changes in the field caused the pattern to break up and rearrange itself, changes of 1 in 10^6 being detected in this way.

5275 Observation of the Photodisintegration of Carbon into Three α Particles. Raymond Chastel. J. phys. radium 11, 291-4(1950) June (in French).

The method of photographic plates is used to determine γ-ray energies from a study of the photodisintegration of carbon into 3 α particles. The γ rays used result from the bombardment of a lithium target by 500-kev protons. The analysis of the photographic plate to determine the α particle energy together with the energy balance equation for the reaction, yield a γ-ray energy in good agreement with results obtained by using a β-ray spectrograph. The different disintegrations observed indicate that the accuracy of this method for the determination of γ-ray energies is of the order of 3 in 100. (auth)

5276 The Photon Yield of Electron-Hole Pairs in Germanium. F. S. Goucher. Phys. Rev. 78, 816(1950) June 15 (Letter to the editor).

A known number of photons per second of monochromatic light of variable wave-length were focussed on a filament cut from a single crystal of n-type germanium. A constant voltage was applied to the filament and photocurrents were measured by a-c techniques, the light being pulsed. Calculations, from the current, of the number of electron-hole pairs produced and, from optical constants, of the number of photons absorbed, indicated a yield of one electron-hole pair per absorbed photon throughout the wavelength range 1.0 to 2.0 μ (just below the limit of photosensitivity).

5277 A Progress Report on the Construction of a Wilson Cloud Chamber with a Magnetic Field to be Sent Aloft in a V-2 Rocket for the Investigation of the Radioactivity of the Upper Atmosphere. E. G.

Ebbighausen. Oregon University, nd. 3p. (AEC File No. NP-1212.)

The design of the instrument is complete and construction is pending a decision on actual use of the instrument in the rocket. The addition of a high intensity magnetic field to the instrument to aid in determining particle energies is discussed.

5278 Research of F. Stockmann on Crystal Counters and Photoconduction. Paul M. Marcus. Office of Naval Research, London. Apr. 27, 1950. 3p. (AEC File No. NP-1580.)

A brief report is given of some of the ideas and current work of Dr. F. Stockmann of Gottingen relating to crystal counters and to the photoconduction effect in crystals. In particular the similarity of the two physical processes is stressed. (auth)

5279 The Response Probability of Counters with Aluminium, Copper, and Gold Cathodes for X-rays in the Energy Range 5 kev to 60 kev. H. Saurer. Helv. Phys. Acta 23, No. 4, 381-411(1950)(in German).

A thorough investigation was made of the efficiency of a G-M counter in the counting of x-rays. The characteristic radiation of various elements was passed, in a thin pencil, through the counter and then into an ionization chamber. The current from the latter, after taking into account the various absorption coefficients along the way, gave the total number N of quanta reaching the effective region of the counter. Dividing the actual counts Z by this total number gave the counting probability A = Z/N. Curves are given showing the radial and axial variations of A throughout the counter for the cases of aluminum, copper-plated, and gold-plated inner walls.

5280 The Scintillation Counter. Robert W. Pringle. Nature 166, 11-14(1950) July 1.

This article reviews certain aspects of the field. Included are discussions on the efficiency of various crystals for different types of radiation, resolving time, properties of some photomultiplier tubes, and some of the experiments in which scintillation crystals have been used. The use of crystal counters as a powerful tool for the nuclear physicist as well as the research biologist and doctor performing tracer experiments is emphasized. 23 references.

5281 Standard Support for Geiger Counter. G. B. Cook and D. Lee. Atomic Energy Research Establishment Report AERE-CR-484, Jan. 1950. 12p.

A suggested standard assembly for Geiger counters is described. It is made of Perspex and consists of a series of shelves on which samples may be placed. Slight variations may occur with counters of different design. The geometrical efficiency of the various positions has not yet been determined, but it is about 5% on the first shelf. In the close position, it is probably of the order of 30 to 40%. The details of construction are available from the drawings attached.

5282 Effect of Temperature, Density, and Velocity of Gases on Dispersion from Stacks. Thomas Baron. SO-1001, June 30, 1950. 12p.

When hot gases and smoke are discharged from a chimney at finite velocities, an effective stack height must be postulated for the application of equations which have been developed for the dispersion of gases and aerosols. The additional height due to the buoyancy and kinetic energy of the gases may be roughly estimated in terms of the temperature difference between the stack gases and the ambient air, or in terms of velocity decay. Rules of thumb are suggested which are based on these parameters. Their use is justified only when better methods of making such an estimation are lacking. (auth)

5283 Entrainment and the Maximum Height of an Atomic Cloud. Lester Machta. Bull. Am. Meteorol. Soc. 31, 215-6(1950) June.

The maximum height of an atomic cloud is calculated using a different method than the one used by Sutton (Weather 2, No. 4, 105-10(1947)). First, instead of mixing the environment's air with that of the cloud through diffusion, the mixing is accomplished by the entrainment of environment air into the rising cloud. Second, the environment is permitted to posses a lapse rate other than the dry adiabatic. The two methods by which the rising atomic cloud is cooled are through adiabatic expansion and mixing with cooler environmental air. The height calculated by the author is 39,800 ft, which is 200 ft less than the estimated height at the Alamogordo test. In view of the simplifications used in the calculations, this excellent agreement is thought to be partly accidental.

5284 Note on "Entrainment and the Maximum Height of an Atomic Cloud" by Lester Machta. O. G. Sutton. Bull. Am. Meteorol. Soc. 31, 217-8(1950) June.

This article is an extension giving a more complete mathematical development of a paper by the author (Weather 2, No. 4, 105-10(1947)) and is, in addition a commentary on an article by L. Machta (Bull. Am. Meteorol. Soc. 31, 215-6 (1950) June). The author states that although he and Machta calculate the height of an atomic cloud following an atomic bomb explosion, the assumptions and methods used are so different that the articles have little in common. The author considers the rising cloud as a heated volume moving upward by buoyancy and drawing in undisturbed cool air by turbulant mixing. The maximum height of the atomic cloud is calculated to be 50,000 ft by this method.

5285 Molecular Microwave Spectra Tables. Paul Kisliuk and Charles H. Townes. J. Research Natl. Bur. Standards 44, 611-42(1950) June.

This paper presents a group of tables that give the frequencies, assignment of quantum numbers, and intensities of more than 700 microwave absorption lines. The best available values of other pertinent molecular data, such as moments of inertia, dipole moments, quadrupole coupling constants, and rotation-vibration constants are also included. The frequencies are listed once for each molecule and again in consecutive ascending order of frequency. References are given for all data included. Frequencies listed to the nearest megacycle were generally measured with a cavity wave meter and may be in error by as much as 10 Mc, whereas those given to a fraction of a megacycle are generally known to an accuracy of about 0.1 Mc. A short discussion of microwave spectra and important formulas is given. For easy calculation of hyperfine structure, Casimir's function is tabulated up to $J = 10$ and $I = \frac{9}{2}$.

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5286 The Complex Band Spectrum of Columbium Oxide (the Diatomic Molecule CbO). V. Ramakrishna Rao. Indian J. Phys. 24, 35-49(1950) Jan.

An extensive band system attributable to the diatomic molecule CbO was obtained in the region from λ 4200 to the limit of sensitivity of the panchromatic plates. The bands are divided into three systems, A, B, C, analogous to the α, β, γ-systems in TiO and ZrO. The vibrational constants were determined for the three systems. Evidence of multiplet structure is found and electronic transitions between quartet terms are suggested as probable.

5287 Excited Electronic Levels in Conjugated Molecules. V. A Valence Bond Estimation of Energy Levels in Aromatic Hydrocarbon Molecules. G. R. Baldock. Proc. Phys. Soc. (London) 63, 585-91(1950) June 1.

This article is concerned with the calculation of the energy of the ground state and the lowest excited state for hydrocarbons of the condensed ring type. The difference between these two energies is the energy of the first electronic transition. The normal valence bond method is used, taking only the Kekulé structures into consideration. The results are compared with the experimental absorption wavelengths, and are in good agreement, giving a value of the exchange integral α between −1.8 and −2 ev. (auth)

5288 The L-M and K-M Discrepancies in the Rare Earths. E. A. Stewardson and H. F. Zandy. Proc. Phys. Soc. (London) 63, 670-1(1950) June 1 (Letter to the editor).

The differences, in many of the heavier elements, between the measured values for the M_{IV} and M_V absorption edges and the values calculated from $M_{IV} = L_{II} - L\beta_1$, $M_{IV} = L_{III} - L\alpha_2$, and $M_V = L_{III} - L\alpha_1$ is attributed to differences in the end levels of the transitions from $L_{II,III}$ and $M_{IV,V}$ induced by absorption. A plot of L-M_V discrepancy against Z, obtained from an investigation of the fine structure of absorption edges of Pr, Nd, Sm, Eu, Gd, Dy, and Yb, suggests that the discrepancy can normally be accounted for by the operation of selection rules, the end levels being in the neighborhood of the conduction bands.

5289 Neutron Spectrum for Protons on Be^9. V. R. Johnson, F. Ajzenberg, and M. J. Wilson Laubenstein. AECU-857, nd. 8p.

The $Be^9(p,n)B^9$ reaction has been investigated as a possible source of monochromatic neutrons in the region below 2.5-Mev neutron energy. A photographic plate technique was used (Johnson, Phys. Rev. 77, 413(1950)), and the results are discussed.

5290 Solution of the Diffusion Equation with Streaming for Three Basic Two Medium Geometries. D. W. Whitcombe and Nicholas M. Smith, Jr. ORNL-403, Oct. 7, 1949. 48p.

The diffusion equation for neutrons emerging from a plane source is solved for the three following geometries: (1) two media with 1 boundary; (2) two media with 2 boundaries; (3) two media with cylindrical geometry. For each geometry several cases are discussed, i.e., infinite and finite plane source, infinite and finite in direction perpendicular to source.

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5291 A Diffusion Solution for a Black Thermal Neutron Pipe Duct Containing a Pure Scattering Material. David W. Whitcombe. ORNL-751, July 5, 1950. 14p.

The diffusion equation is solved for thermal neutrons in a liquid metal pipe. The solutions contain the extrapolated radius and length of the pipe. A sample problem to determine the neutron current emerging from the end of a pipe is included.

5292 Capture Cross Section of Slow Neutrons and Nuclear Structure. Georges-J. Bene, Pierre-M. Denis, and Richard-C. Extermann. Arch. sci. 3, 162-5(1950) Mar. 16 (in French).

The capture cross sections for slow neutrons are plotted semi-logarithmically for nuclei with odd and even Z. The magic numbers and sub shells show up as minima in these curves. The authors state that additional information derived from these curves provide further confirmation for the nuclear model proposed by Maria G. Mayer (Phys. Rev. 75, 1969(1949)).

5293 The Measurement of Slow-Neutron Absorption Cross-Sections. D. J. Littler. Atomics 1, 189-95, 200(1950) July.

Various methods of measuring slow-neutron absorption cross sections are described. The absolute methods include attenuation of monokinetic beams as obtained by choppers and crystal diffraction, activation of single isotope elements in a known neutron flux, and finding of diffusion lengths in elements with very small absorption cross sections. The comparative methods include placing the sample in a pile and noting the necessary change in control rod setting, modulating the pile output by periodic introduction of the sample, and oscillating the sample into and out of a boron chamber in a constant neutron flux to modulate the current from the chamber.

5294 Research with Neutrons. Atomics (London) 1, 202-8(1950) July.

Taken from the 7th Semiannual Report of the United States Atomic Energy Commission, this article deals with a variety of topics all related to neutron research. Available sources of neutrons, techniques for energy sorting, methods of detecting, measurements of cross sections, and polarization are among those given brief treatment.

5295 The Harwell Atomic Energy Research Establishment. Engineering 169, 734-5(1950) June 30.

The Harwell cyclotron and the second experimental pile, known as Bepo, are given very brief mention, as are two new buildings and their use as chemical engineering and radiochemical laboratories.

5296 Search for Nuclear Energy Levels in C^{13}. L. W. Miller. AECU-858, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

In 1935 Paton (Phys. Rev. 47, 197(1945)) determined the energies of four groups of protons produced by the bombardment of boron with alpha particles. Two of these groups were believed to correspond to levels of the residual nucleus in the $B^{10}(\alpha,p)C^{13}$ reaction at 4.9 and 6.0-Mev excitation energies (Livingston and Bethe, Rev. Mod. Phys. 9, 299(1937)). Investigating the same reaction using enriched B^{10} samples,

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Greagen (Phys. Rev. 76, 1769(1949)) reported possible evidence for a level in C^{13} at 5.6 Mev. One might expect that these levels would also appear as resonances in the total cross section of carbon for fast neutrons. Earlier measurements of this cross section (Fields, et al, Phys. Rev. 71, 508(1947); Lampi, et al, Phys. Rev. 76, 188(1949); Frisch, Phys. Rev. 70, 589(1946)) did not show resonances corresponding to these levels, but there was a possibility that narrow resonances had been missed because of the wide spacing of experimental points.

In the present investigation the total cross section of carbon for fast neutrons was determined for neutron energies between 20 and 1360 kev. By means of a transmission experiment of the type previously described (Barschall et al, Phys. Rev. 76, 1146(1949)), the cross section was measured with neutrons produced by the $Li^7(p,n)Be^7$ reaction. The neutron energy spread was about 13 kev below 900 kev neutron energy and 200 kev above this energy. Experimental points were taken at intervals of 10 kev below 900 kev and 22 kev above this energy. A smooth monotonic decrease in the total cross section from 4.8 barns at 20-kev neutron energy to 2.4 barns at 1360-kev neutron energy was obtained. Throughout this energy region the standard statistical error in the cross section was less than 5%. The observed total cross section agrees with the results of the Minnesota group (Lampi et al, Phys. Rev. 76, 188(1949)) and of Wattenberg et al, (Phys. Rev. 71, 508(1947)) to within 3%, except for one point obtained by Lampi, et al, (Phys. Rev. 76, 188(1949)), at 1340 kev which is 9% lower than the present measurement.

If resonances were to be observed corresponding to possible levels in C^{13} listed by Hornyak and Lauritsen (Rev. Mod. Phys. 20, 209(1948)) at 5.0 and 6.0 Mev excitation energies, they should appear at neutron energies of 130 kev and 1210 kev. On the basis of Breit-Wigner resonance theory, the variation in cross section for such resonances should be at least 24 barns and 2.5 barns, respectively. No resonances were observed; the maximum deviation of the experimental points from the smooth curve was about 0.5 barn for neutrons below 400 kev and about 0.2 barn above this energy. On the basis of the resolution used, it may be estimated that the natural width of such levels if they exist is less than 5 kev.

5297 The Nuclear Magnetic Moment of Scandium-45. Robert E. Sheriff and Dudley Williams. Phys. Rev. 79, 175(1950) July 1 (Letter to the editor).

The nuclear magnetic resonance due to Sc^{45}, in an aqueous solution of $ScCl_3$ was located, the ratio of the resonance frequency of the signal to that of the Br^{79} signal in the same magnetic field being 0.96954 ± 0.00006. From this the nuclear g-value of Sc^{45} is found to be $g(Sc^{45}) = 1.3605 \pm 0.0003$ and the magnetic moment to be $\mu(Sc^{45}) = 4.7617 \pm 0.0010$ nuclear magnetons.

5298 Nuclear Magnetic Relaxation in Metallic Lithium and Aluminium. N. J. Poulis. Physica 16, 373-6 (1950) Apr.

Nuclear magnetic resonance absorption has been observed in metallic Al^{27} at a frequency of 9.5 Mc/sec and in Li^7 at 15.2, 9.5, and 6.4 Mc/sec. The relaxation time τ_1 was measured at temperatures from 20 to 1.2°K. For Li, τ_1 increased with increasing frequency. The line width in lithium was about 3.5 oersteds, in aluminum about 9 oersteds.

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5299 On the Magnetic Moments of Tl^{203}, Tl^{205}, Sn^{115}, Sn^{117}, Sn^{119}, Cd^{111}, Cd^{113}, and Pb^{207}. W. G. Proctor. Phys. Rev. 79, 35-44(1950) July 1.

A radiofrequency spectrometer for observing nuclear induction signals is described. The use of crossed r-f coils allows, in a simple fashion, the determination of the signs of the magnetic moments. The spectrometer has been used to determine the magnetic moments and magnetic moment ratios of the nuclei referred to in the title. These values are based on a proton moment, without diamagnetic correction, of 2.7935 ± 0.0003 nuclear magnetons. (auth)

5300 A Table for Simplifying Calculations of Activities Produced by Thermal Neutrons. F. E. Senftle and W. Z. Leavitt. NYO-586, May 1, 1950. 18p.

The formula used to calculate the activity produced in a particular nuclide by thermal neutron irradiation has been modified and presented in simpler form. The new form involves constants which are characteristic of the nuclide under consideration. A table of constants for most of the nuclides whose capture cross sections have been measured has been prepared. (auth)

5301 Preparation of a New Isotope of Francium — Fr^{222}. E. K. Hyde and A. Ghiorso. UCRL-593, Feb. 4, 1950. 8p.

A new 14.8-min β-emitting isotope of francium has been prepared by high energy proton bombardment of thorium and identified as Fr^{222} by means of its α-emitting daughters. (auth)

5302 Summary of the Research Progress Meeting of March 30, 1950. Henry P. Kramer. UCRL-654, Apr. 19, 1950. 9p.

Research in the following topics is discussed: additional evidence of the existence of the neutral meson; search for (α,γ) and $(\alpha,2p)$ reactions.

5303 "Fission" of Medium Weight Elements. Roger T. Batzel and Glenn T. Seaborg. UCRL-716, May 29, 1950. 6p.

Several isotopes (Cu^{63}, Br^{79}, Ag^{107}, and Sn^{118}) were bombarded with energetic protons (≥60 Mev depending on the target). In all cases the isotope resulting from the reaction had a mass slightly greater than one-half the mass of the target isotope, provided the incident proton had the threshold energy for the reaction. From the mass energy balance equation and an estimation of the energy α particles would need to penetrate the coulomb barrier in sufficient amounts to satisfy the cross sections obtained, it is concluded that these were not spallation reactions, but more properly a "fission" process.

5304 Low Energy Alpha-Particles from Fluorine Bombarded by Protons. C. Y. Chao, A. V. Tollestrup, W. A. Fowler, and C. C. Lauritsen. Phys. Rev. 79, 108-16(1950) July 1.

The low energy α groups from the reaction $F^{19}(p,\alpha)O^{16*}$ have been studied at various resonances between proton energies of 340 and 1381 kev. Four groups have been identified. For the reaction energy of the α_π group, preceding the pair emission, we find $Q_\pi = 2.061 \pm 0.010$ Mev and for the three other groups preceding γ-ray emission we find $Q_1 = 1.977 \pm 0.008$, $Q_2 = 1.204 \pm 0.008$, and $Q_3 = 1.002 \pm$

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0.008 Mev. Each of the Q-values when added to the corresponding pair-energy or γ-ray energy found by Rasmussen et al, (Phys. Rev. 77, 617(1950)) gives a value for the total reaction energy of $F^{18}(p,\alpha)O^{16}$ which is the same for all the groups, namely 8.113 ± 0.030 Mev. The relative intensities of the α_1, α_2, and α_3 groups, are found to vary from one resonance to another and the sum of their absolute yields per proton per 4π-steradians at 138 deg is found to be very close to the absolute yield of the γ rays per proton per 4π-steradians at 90 deg at all the resonances investigated, the γ-ray yield being measured simultaneously with the α-particle yields. The absolute yield of the α_π group agrees in order of magnitude with the pair yield. (auth)

5305 Proton Groups from the Deuteron Bombardment of Aluminum, Sodium, and Manganese. W. D. Whitehead and N. P. Heydenburg. Phys. Rev. 79, 99-103 (1950) July 1.

Thin targets of sodium, aluminum, and manganese were bombarded with 3.0-Mev deuterons from the large electrostatic generator at the Department of Terrestrial Magnetism, and the protons were observed at 90 deg. to the beam with an argon-filled proportional counter. The counter was biased to count protons at the end of their range and the ranges of the groups were measured in air and aluminum. Proton groups due to oxygen and carbon were found with all targets. (auth)

5306 The Theory of Photodisintegration and Formation of H^3 and He^3. Mario Verde. Helv. Phys. Acta 23, No. 4, 453-74(1950) (in German).

The photodisintegration, and formation by radiative capture, of the two nuclei H^3 and He^3 are well suited to give information on their configuration and on the nature of nuclear forces. The problem is here treated theoretically, taking into account the symmetry properties in ordinary space and in the spin and isotopic spin spaces. The ground states of H^3 and He^3, appearing to be predominantly totally symmetric in the space coordinates, are discussed as well as various transitions to a ^3S deuteron and a nucleon. Direct transition to three free nucleons and the reverse process of nucleon capture by a deuteron are also treated.

5307 Total Neutron Cross Section of Vanadium from 10 to 1000 Kev. J. Morris Blair and J. R. Wallace. Phys. Rev. 79, 28-30(1950) July 1.

The total cross section of vanadium for neutrons of 10 to 1000 kev has been measured with an energy resolution of ±6 kev. For low energy neutrons the values of the cross sections fluctuate rapidly, leveling off to an average of about 3 barns above 500 kev. By using a filtering technique a cross section of 0.0 ± 0.5 barn was measured at 105 kev. (auth)

5308 Synchrotron-Oscillation Resonance. Nelson M. Blachman. AECU-866, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Although detrimental betatron-oscillation resonances have been studied, (Courant, J. Appl. Phys. 20, 611(1949); Dennison and Berlin, Phys. Rev. 69, 542 and 70, 764(1946); Blachman and Courant, Rev. Sci. Inst. 20, 596(1949)), synchrotron-oscillation resonance in a synchrotron has received less attention. The latter's frequency is much lower than the former's, varying from 2620 to 1800 cps in the Brookhaven proton synchrotron, and resonance may occur with power-supply harmonics. The Brookhaven maget is powered by a nominally 60-cycle generator and 12-phase rectifier having significant output components at multiples of 720 cps; the third given cause for concern. The corresponding ripple of the magnetic field is extremely small because of the magnet's inductance, yet a large synchrotron oscillation may result, losing much of the beam. An extremely small ripple in the accelerating frequency, not expected to be present, would have a similar effect; the synchrotron is less sensitive to amplitude modulation. The effect of the magnetic field ripple, if not filtered out, may be corrected by introducing compensatory FM or AM. Such FM will be introduced by the system which continuously produces the proper frequency for the magnetic field, though some error may be present. The fall in synchrotron-oscillation frequency with increasing amplitude also helps by its detuning effect.

5309 Proton Linear Accelerators. Wolfgang, K. H. Panofsky. UCRL-696, May 5, 1950. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The basic factors affecting the design of proton linear accelerators are discussed. These include factors affecting choice of wavelength, cavity geometry, field gradient, and injection energy. The beam dynamics of the ions in a linear accelerator are discussed with special regard to the need of special focusing means such as foils or grids. The performance of the Berkeley 32-Mev accelerator during the last two years is being discussed with special regard to the foregoing principles.

5310 X-ray Beam Shaper for the Berkeley Synchrotron. Gervase Gauer and Craig Nunan. UCRL-714, May 23, 1950. 4p.

The document is in abstract form; it is reproduced below in its entirety.

In counting experiments with high energy accelerators, the ratio of real counts to accidental counts is usually proportional to the first or an even higher power of the duty cycle. Ideally, one would like a continuous x-ray beam with a duty cycle of unity. The Berkeley synchrotron is operated at a repetition rate of six pulses per second and with no beam shaping the x-ray pulse lasts less than 10 μsec. This represents a duty cycle of 0.006%. With proper shaping of the radio frequency pulse we have obtained a duty cycle of 3%, with an x-ray pulse 3000 μsec long.

This long x-ray pulse has been a principal factor in the success of recent meson-counting experiments with the Berkeley synchrotron. The Berkeley synchrotron accelerates electrons to 341 Mev in a magnetic field which rises sinusoidally to 11,400 gauss in 7800 μsec. The electrons are injected by a diode gun operating at 100 kv and are then accelerated to 2 Mev by betatron action. The radio frequency field is then turned on and the electrons gain sufficient energy on each revolution to keep in phase with the rising magnetic field. Fig. 1, curve (a), shows the energy the electrons must gain each revolution. At low energy the minimum accelerating voltage is determined primarily by the rate of change of magnetic field. At high energy the electrons radiate electromagnetic energy and this becomes the primary factor in determining the minimum accelerating voltage. When the magnetic field has reached peak

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value, the r-f voltage is shut off and the electrons spiral in and strike the target, producing the x-ray beam.

Professor E. M. McMillan suggested that the x-ray pulse could be lengthened by making the r-f voltage slowly approach curve (a) of Fig. 1. Then the electrons which were farthest out of phase with the r-f voltage would drop out of the synchronous bunch first and would spiral into the target to produce x-rays. By making the asymptotic approach of the two curves last for several thousand microseconds the electron bunch could gradually be diminished and an x-ray pulse of uniform intensity should be obtained over this time. In order to maintain maximum x-ray beam energy, the x-ray pulse should be centered about the time of peak magnetic field. This abstract briefly describes the system we have developed for shaping the r-f accelerating voltage.

The beam shaper essentially is a plate modulator for the radio frequency oscillator. It turns on the r-f oscillator at the proper time, maintains a constant r-f voltage for roughly 6000 μsec and then lowers the voltage to zero along a parabolic path to correspond to curve (a) of Fig. 1. (The last 4500 μsec of curve (a) approximates a parabola).

Basically the circuits are conventional. Since the 304th modulator tubes and the associated circuits shown in the dotted box of Fig. 2 are several thousand volts above ground, it is necessary to transformer-isolate this section from the control circuits. Therefore, a local oscillator of nominally 10 Mc is modulated with the proper envelope and the modulated 10 Mc is detected, amplified and applied to the grids of the 304th's.

The modulating wave shapes are generated by a phantastron square wave generator and by a squaring circuit. The phantastron generates a square pulse lasting about 9000 μsec. After approximately 6000 μsec the parabolic pulse is generated and subtracted from the end of the square pulse. Timing and amplitude controls are provided so that a uniformly intense beam from the synchrotron may be obtained. 2 figures.

5311 Experiments with a 6-Mev Betatron. K. Gund and W. Paul. Nucleonics 7, No. 1, 36-45 (1950) July.

Work with the 6-Mev betatron at the II. Physics Institute of Gottingen University has progressed to treatment of cancers and tumors in humans. Besides describing the construction of the instrument, which is provided with a .05-mm copper foil exit portal over a quarter of the circumference to facilitate electron therapy, this article reviews preliminary physical and biological experiments and results. Much work was done in making direct comparisons between the biological effects of fast electrons and of x-rays. Electrons were found to have a more favorable dose distribution in tissue and greater favoring of healing processes.

5312 High Frequency Betatron. Gordon F. Hull, Jr. Office of Naval Research, London, Technical Report No. ONRL-48-50, Apr. 20, 1950. 4p.

A high frequency betatron developed by the Philips Laboratory at Eindhoven is described and some of its characteristics given. This betatron is light and compact compared to iron cored betatrons operating at low frequency. It will deliver x-ray energies from 5 to 9 Mev. At 5 Mev the radiation is 50 μr per injection at 1 m. (auth)

5313 Precision Scattering Project; Equipment Design. Edward M. Reilley, III, and Ralph L. Ely, Jr. University of Pittsburgh Radiation Laboratory Report No. 1, Apr. 18, 1950. 57p. (AEC File No. NP-1537.)

The Precision Scattering Program is designed to make use of the cyclotron beam for precision scattering measurements of nuclear particles in the medium energy range from 10 to 30 Mev. The general method is outlined and the design of the more pertinent equipment is shown. A modification of the Los Alamos model 600 ionization and thermocouple gauge control unit possessing several advantages over the original unit is shown. A magnet current control has been designed which will maintain the magnet current constant to at least 1 part in 50,000. The design of the magnet pole tip shapes is carried out and it is shown that the fringing flux can allow a reduction of approximately 20% in size over the classical calculation. (auth)

5314 Shielding Plan for the Stanford Linear Accelerator. Stanford University Microwave Laboratory, Feb. 1950. 11p. (AEC File No. NP-1443.)

The projected production of billion-volt electrons introduces some new shielding problems. For guidance in design, an attempt has been made to estimate the amount of shielding required by the various parts of the accelerator and associated equipment. The shielding actually used must in any case be checked by detailed and continuing radiation surveys. During construction such surveys will indicate when it is safe to raise the voltage or beam current. Theoretical predictions are also useful in showing the types of radiation to be expected and the types of monitoring to be used. The estimates made are not intended to represent the best calculations that could be made with the most recent information, but merely to give a reasonably reliable estimate based upon such information as was readily available at the time. (auth)

5315 Low Energy Neutron Resonance Scattering and Absorption. S. P. Harris, C. O. Muehlhause, and G. E. Thomas. ANL-4430, Oct. 17, 1949. 27p.

Low energy neutron resonance absorption and scattering integrals have been measured and resonance scattering fractions, Γ_n/Γ, have been determined for about 30 elements. Light weight odd Z - even N and even Z - odd N isotopes are shown to have similar resonance phenomena. Correlations of level density and scattering fraction with atomic weight and nuclear type are presented. 26 references. (auth)

5316 Angular Distribution and Intensity of 70-Mev X-rays from Various Targets. G. C. Baldwin, F. I. Boley, and H. C. Pollock. RL-374, Apr. 1950. 22p.

Measurements are reported of the angular distribution and relative intensity of x-radiation generated by 70-Mev electrons in aluminum, copper, molybdenum, tungsten, and platinum targets of various thicknesses. The synchrotron beam was alternately contracted to an inner reference target and expanded to an outer, experimental target carried by a mechanism with which targets could be changed without breaking the vacuum. Two arrays of small ionization chambers were used to measure the intensity distribution in each of the resulting x-ray beams. The results are compared with theoretical beam shapes and intensities calculated from multiple scattering and "bremsstrahlung" theory. Excellent agreement with theory is found for aluminum and copper targets of thicknesses of the order of 10^{-2} radiation units. Similar

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targets of higher atomic number show increasing deviations, indicating that multiple scattering and radiation in these elements are less than predicted from theory. Aluminum targets of thicknesses below 10^{-3} radiation units show deviations ascribed to multiple transits by the electron beam. Considerations regarding the use of various targets to obtain desired type beams (for maximum output or for narrow or broad beams) are discussed. (auth)

5317 Photo-Ejection of Protons. C. Levinthal and A. Silverman. UCRL-761, June 20, 1950. 6p.

A proportional counter telescope system has been used to measure the energy and angular distribution of protons ejected from various targets by the gamma-ray beam of the Berkeley synchrotron. Energy distribution from 8 to 70 Mev have been obtained at 90 deg to the beam direction using carbon, copper, and lead targets. The results can be quite well represented by $N(E) = K/E^n$. N(E) is the proton yield per Mev at energy E. K is a constant, different for each element but independent of energy; and $n = 1.7 \pm 0.1$ for carbon; 1.9 ± 0.1 for copper; and 2.2 ± 0.2 for lead. The lead distribution shows the expected decrease below the coulomb barrier. The relative yields at 40 Mev with about 5% statistical errors are 6.0, 26.7, and 75.0 for carbon, copper, and lead, respectively. Thus, for these three elements the cross sections are approximately proportional to the number of protons in the target nucleus. It is shown that the distribution is approximately spherically symmetric at the lower energy and has a pronounced forward peak at the higher energy. The authors believe that the mechanism is one of direct photoelectric ejection of a proton and not an evaporation process because of the angular assymetry of ejection of the protons.

5318 I. Phenomenological Interpretation of High Energy Proton-Proton Scattering. II. Meson Production by Protons on Deuterons. Henry P. Noyes. UCRL-710, nd. 63p.

Part I is an attempt to fit proton-proton scattering data, obtained elsewhere at 32 and 350 Mev, by the use of static nuclear potentials. It is shown that the 32-Mev data can be fitted by means of two combinations of central and tensor force. (1) The radial dependence is chosen the same for the central and tensor potential; the best fit is then with an exponential radial dependence of range 0.7×10^{-13} cm and with a tensor depth of ±50 Mev; this model fits the counter data better than the photographic data. (2) The radial dependence is singular for the tensor potential and shallow and cut off for the central potential; the best fit is with a singlet square well of range 2.6×10^{-13} cm and with either a $V_t \exp(-r/R)/(r/R)$ radial dependence (with $R = 1.3 \times 10^{-13}$ cm and $V_t = \pm 26$ Mev) or with a more singular potential $V_t \exp(-r/R)(r/R)^2$ with $R = 2.0 \times 10^{-13}$ cm and $V_t = \pm 22$ Mev. These combinations give better fits to the photographic data. To fit the 350-Mev data it is shown that a very singular tensor force must be used, such as the $\exp(-r/R)(r/R)^2$. The essential feature is that there must be a strong interaction in regions less than 0.5×10^{-13} cm. The best fit of the combined data is therefore obtained by using the singular potential so adjusted that approximately one-third of the nuclear scattering at 32 Mev is accountable to tensor scattering. The present data are not sufficiently extensive to permit very precise specifications of the radial form.

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Part II attempts to predict the energy and angular distribution of mesons resulting from the bombardment of deuterium by 345-Mev protons, under the assumption that the cross section for the production of mesons in two nucleon collisions is known. Alternatively, since neutron sources of sufficient energy for the study of the production of mesons in n-p collisions are not readily available, this analysis can offer a method for learning something of this cross section. The method of attacking the problem rests on two assumptions: (1) the production takes place in a time so short compared to the period of the deuteron that the impulse approximation may be used; (2) the particles which produce the meson do not then interact with the third particles except in so far as the exclusion principle limits the states available to them. The scattering matrix for the problem is derived.

5319 The Absorption Curves of Ru^{103} and Ru^{106}. A. W. Kenny and W. R. E. Maton. Atomic Energy Research Establishment Report AERE-CR-513, Apr. 1950. 13p.

The absorption in aluminum of the radiations from Ru^{103} (obtained by a slow neutron irradiation of ruthenium in the Harwell pile) and Ru^{106} (obtained as a fission product) has been measured in a windowless counter. The absorption curves are interpreted in terms of the reported radiations of these isotopes. (auth)

5320 Fine Structure of the Rayleigh Line in Amorphous Substances. R. S. Krishnan. Nature 165, 933-4 (1950) June 10 (Letter to the editor).

To demonstrate that Brillouin components are present in light scattered by amorphous material, as they are in the case of liquids or crystals, the 2536A radiation of mercury was passed through fused quartz and then absorbed in mercury vapor. The displaced structure was not absorbed and so could be clearly photographed without being obscured by the predominant undisplaced line.

5321 Note on the High Energy Neutron-Proton Scattering. S. Hiroishi and H. Tanaka. Prog. Theor. Phys. (Japan) 5, 134-5(1950) Jan.-Feb. (Letter to the editor).

The n-p scattering cross section is calculated as 0.11 barn at 100-Mev incident energy and as 0.06 barn at 300 Mev. Brief mention is made of the phase shift method employed.

5322 Polarization of Neutrons and Protons by Scattering. Joseph V. Lepore. Phys. Rev. 79, 137-42(1950) July 1.

Neutrons and protons can be polarized by scattering provided there is a spin-orbit interaction between the incident particle and the scattering nucleus. The polarization effect has been found for a nucleus of spin zero allowing for the possibility of resonance scattering. Particular attention has been paid to the resonance scattering of neutrons by He^4 where almost full polarizations can be obtained, together with large cross sections. The polarization can be detected by a double scattering experiment, since the second scattering will be axially asymmetric with respect to the direction of the first scattered neutron. The existence of this effect and a preliminary treatment of it was first pointed out by Schwinger (Phys. Rev. 69, 681(1946)). The

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scattering of polarized neutrons by protons has been studied for potentials suggested by the symmetrical, charged, and neutral meson theories. The polarization effect on the differential cross section is negligible for the symmetrical theory, but is significant for the other two. (auth)

5323 The Quantal Theory of Continuous Absorption of Radiation by Various Atoms in Their Ground States. II. Further Calculations on Oxygen, Nitrogen and Carbon. D. R. Bates and M. J. Seaton. Monthly Notices Royal Astron. Soc. 109, No. 6, 698-704(1949).

Atomic oxygen is selected as a system for detained quantal calculations of its continuous radiative absorption cross section, partly because it is a typical representative of an important group, but mainly because accurate knowledge of its absorption cross section is required in the theory of the formation of the ionized layers of the earth's upper atmosphere; atomic nitrogen and carbon are also treated, but less fully. Exchange wave functions and both the dipole moment and dipole velocity formulas are used. At the spectral heads the absorption cross sections, in units 10^{-18} cm^2, are as follows: O, 2.6; N, 9; C, 11.

5324 The Scattering of High Energy Charged Particles by Thin Foils of Matter. S. T. Butler. Proc. Phys. Soc. (London) 63, 599-605(1950) June 1.

The distribution of high energy charged particles scattered by a thin foil has been investigated and compared with the formula for single scattering. It is shown that, at sufficiently large angles, the distribution approaches that for single scattering and can be expressed in the form of a rapidly convergent series of which the first term is identical with the single scattering formula. The remaining terms of the series form an accurate expression for the deviation from true single scattering. The simplified case of projected scattering has also been considered. (auth)

5325 The Half-Life of Sodium^{24}. A. K. Solomon. AECU-861, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

In the course of biological experiments using Na^{24} as a tracer, half-life values appreciably longer than 14.8 hr, as given by Van Voorhis (Phys. Rev. 49, 889(1936)), were consistently obtained. As a consequence the half-life has been redetermined on samples of radioactive sodium procured from the Isotopes Division of the United States Atomic Energy Commission at Oak Ridge, Tennessee.

The material, after receipt from Oak Ridge, was purified by the use of ion enchangers. First, the material was adsorbed on a Dowex 50 column and then eluted with 0.15N HCl, according to the method of Cohn and Kohn (J. Am. Chem Soc. 70, 1986(1948)). This procedure effects a quantitative separation between sodium and potassium, and may, therefore, be expected to separate the sodium from all other cationic contaminants. However, sodium purified in this fashion still contained about 0.15% of a long-lived impurity. The eluate from the Dowex 50 column was, therefore, further purified by passage through a column containing the anion adsorption resin, Amberlite IR-4B. A sample so purified was followed for a period of 13 half-lives, from 103,000 to 17 cpm, with no departure from a logarithmic dependence of activity upon time. All samples were purified by the same method.

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Samples were counted on a windowless proportional counter developed by C. V. Robinson. Since proportional counters have no dead time correction, counts were made up to rates of 100,000 cpm. No departure from linear behavior has been observed up to this rate. The low background of the counter, 3 to 4 cpm, permitted accurate counting at low activities. The disintegration constant was determined by fitting the data using the method of least squares. The average half-live is 15.04 hr with a standard deviation of 0.06 hr. Results of individual runs are given in the following tabulation.

Na^{24} Half-Lives

Experiment number	Half-Life
1	14.95
2	15.06
3	15.06
4	15.03
5	15.04
6	14.98
7	15.12
Average	15.04 ± 0.06

5326 The Question of Isomerism in Ti^{51}. J. Miskel, E. der Mateosian, and M. Goldhaber. AECU-865, nd. 2p.

This is not an abstract; the document is reproduced below in its entirety.

It was shown in the preceding note that of the two reported cases of isomerism for 29 odd neutrons in even-odd nuclei, viz. Ca^{49} and Ti^{51}, the first case could not be confirmed and that in the second case some doubt was thrown on the existence of the "well-known" 72-day activity of Ti^{51}, isomeric with 6-min Ti^{51}. To investigate this activity further we obtained a source of Ti^{51} (72d) of nominally 0.5 mc intensity, from Oak Ridge, where it had been produced by slow neutron bombardment of TiO_2.

To obtain hints for possible chemical impurities in the sample the photon component was studied with the help of physical devices of fairly specific response: the proportional counter for low energy photons and a photo-neutron detector for high energy photons. In this way the presence of Hf^{181} (46d) was indicated by the detection of the L radiation accompanying its decay and that of Sb^{124} (60d) by the photoneutrons which its γ-rays produced in Be. The spectroscopic analysis accompanying the TiO_2 sample had revealed neither Hf nor Sb. The titanium was purified by repeated distillation of $TiCl_4$ (bp 136.4°C) prepared from the irradiated TiO_2 after precipitation of Sb as sulfide. Carriers were added for suspected impurities during the purification. After purification a sample of 200 mg TiO_2 spread over an area of about 10 cm^2 showed an activity of only 4 cpm on an end window counter. This activity was not further studied. It represented a reduction from the original activity by a factor of $\sim 10^5$. It is therefore probable that no 72d Ti^{51} exists, and that previous observers were uncovering an apparent activity with the theory of nuclear shell structure with spin orbit coupling no case of isomerism for less than 39 odd nucleons is now known for even-odd nuclei.

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5327 New Neutron Deficient Radioactive Isotopes of Rare Earths and Osmium. Betsy M. Jones. UCRL-656, Apr. 19, 1950. 53p.

The new neutron deficient isotopes of lanthanum, cerium, praseodymium, neodymium, and osmium are products of (p,xn) reactions. Bombardments with protons of energy 40 Mev and greater were made in the 184-in. cyclotron, and energies of 10 to 32 Mev were obtained with the linear accelerator. The characterization of each new activity consisted of the determination of atomic number and mass number, the identification of the radiations, and the determination of the energies and the relative abundances of the various radiations.

Table 1 — New Isotopes

Isotope	Radiations	Half-life	Energies in Mev: Particles	Energies in Mev: γ-rays	Produced By
$_{57}La^{134}$	β^+, K	6.5 ± 0.25 min	2.7	no γ	Ce^{134} decay
$_{58}Ce^{133}$	β^+, K, γ	6.30 ± 0.1 hr	1.3	1.8	La(p,7n)
$_{58}Ce^{134}$	K	72.0 ± 0.5 hr		no γ	La(p,6n)
$_{59}Pr^{136}$	e^-, β^+, K, γ	120 ± 5 min	0.24(e^-), 1.4(β^+)	0.16, 1.3	Ce(p,3n)
$_{59}Pr^{135}$	β^+, K, γ	4.50 ± 0.5 hr	1.0	1.0	Ce(p,2n)
$_{60}Nd^{135}$	β^+, K γ	22 ± 2 min	2.4		Pr(p,3n)
$_{60}Nd^{139}$	e^-, β^+, K, γ	5.50 ± 0.5 hr	0.28(e^-), 3.1(β^+)	1.1	Pr(p,3n)
$_{76}Os^{162}$	K γ	24.0 ± 1 hr			Re(p,4n)
$_{76}Os^{163}$	e^-, K, γ	12.0 ± 0.5 hr	0.15(e^-), 0.42(β^+)	0.34, 1.6	Re(p,3n)
Revised values					
$_{58}Ce^{135}$		22 hr	0.80 β^+		La(p,5n)
$_{58}Ce^{137}$			0.24 e^-		La(p,3n)

5328 A New Radioactive Isotope of Erbium. Geoffrey Wilkinson and Harry G. Hicks. UCRL-744, June 9, 1950. 4p.

This is not an abstract; the document is reproduced in its entirety.

Very pure dysprosium oxide was bombarded with 38-Mev α particles from the 60-in. Crocker Laboratory cyclotron and the rare earth elements were subsequently chemically separated by the ion exchange resin column method (G. Wilkinson, H. G. Hicks, Phys. Rev. 75, 1370 (1949)). The holmium fraction was found to contain mainly the well known beta particle emitting 27.0 hr Ho^{166} activity, together with weak long-lived activity, which was probably due to Ho^{162} and Ho^{163}. The activity could be formed by both α,p reaction on Dy^{163} and by α,pn, reaction on Dy^{164}; the gross yield from natural dysprosium was approximately 10^{-3} barns.

The erbium fraction contained a new activity whose decay, followed through 6 periods, gave a half-life of 11.2 ± 0.2 hr. The aluminum, beryllium, and lead absorption curves showed the radiations to consist mainly of electromagnetic radiations corresponding to the average energies of holmium L and K x-radiation, 7.2 and 52 kev, respectively, hard gamma radiation of 1.1 Mev energy and very soft electrons of total range ~10 mg/cm² aluminum (~80 kev) in very low yield. The ratios of the various radiations, correcting for absorption in counter window, etc., and assuming counting efficiencies in the standard argon-alcohol tubes used of 10 and 0.5%, respectively, with fluorescence yields of 0.5 and 0.8 for L and K x-radiation, respectively, are approximately e^-: L x-ray: K x-ray: 1.1 Mev γ ray = ~10^{-3}: ~0.5:1:~0.2. Possible allocations for the new isotope are masses 161, 163, or 165, since Er^{162} and Er^{164} are stable. The yield, assuming K x-radiation to represent disintegration by orbital electron capture, is too high for production from Dy^{160} and corresponds to the yield to be expected for an α,3n reaction with a cross section of ~0.8 barns in one of the more abundant dysprosium isotopes. Since no 11-hr activity, indeed no activity at all of half-life greater than 1 hr, was detected in the column separated erbium fraction from holmium bombarded with 19-Mev deuterons, allocation of the 11-hr activity should be made to Ho^{163}. This is confirmed by detection of an activity of ~5 days half-life identified as the 5.1-day Ho^{163} in the erbium sample after decay of the 11-hr activity.

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5329 A Note on 11.5-Day Tl^{203}. Geoffrey Wilkinson. UCRL-750, June 22, 1950, 4p.

This is not an abstract; the document is reproduced in its entirety.

This well known (G. T. Seaborg, I. Perlman. Rev. Mod. Phys. 20, 585 (1948)) isotope has been re-examined to check on the possibility of negative beta particle decay. The activity was produced by deuteron bombardment of mercury. The target consisted of dental amalgam (5 parts commercial alloy to 9 parts of mercury by weight) pounded into a channel in a water-cooled copper plate; no loss was apparent during several hours bombardment with a 10 μ amp deuteron beam. After dissolving the target in nitric acid, the solution was made >6N in hydrochloric acid and the thallium extracted by ether. The ether was evaporated, hold back carriers were added and the thallium was re-extracted. No carrier was added. After four extraction cycles additional chemistry on a portion of the sample showed this to be pure thallium. The aluminum and lead absorption curves taken on carrierless samples mounted on very thin backing showed electrons range 100 mg/cm² aluminum (0.35 Mev), L and K x-radiation and a gamma ray of half thickness 3.7 g/cm² lead (0.43 Mev). The ratios of the radiations corrected for absorption in counter windows, fluorescence yield, counting efficiency, etc., were 0.35 Mev e^-: L x-ray; K x-ray: 0.43 Mev γ = ~0.1: ~1.7: 1:0.6. Assuming that both L and K x-radiations are produced from conversion, then ~0.9 of the measured K x-radiation represents one disintegration by K electron capture. Since only 0.7 L rays are to be expected for each K shell electron removed it appears that the isotope decays almost equally by L and K orbital electron capture.

From a study on a 257° mirrow focusing spectrometer, the γ ray energy was determined as 0.427 Mev. No evidence for a continuous beta spectrum could be determined either in absorptions or on the spectrometer.

The decay of electrons and electromagnetic radiations followed separately through over eight periods gave a value of 11.50 ± 0.05 days for the half-life after subtraction of background which was due to the 2.7-yr Tl^{204}.

5330 A Note on Promethium 143. Geoffrey Wilkinson and Harry G. Hicks. UCRL-751, June 12, 1950. 4p.

This is not an abstract; the document is reproduced in its entirety.

The long-lived activity produced by α-particle bombardment of praseodymium (C. S. Wu, E. Segre, Phys. Rev. 61, 203 (1942)) has been re-studied. Very pure praseodymium oxide, prepared by ion exchange resin column separation, was bombarded with α particles of 15 to 38 Mev energy using the 60-in. Crocker Laboratory cyclotron. The long-lived

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activity formed was conclusively shown to be due to a promethium isotope by ion exchange column separation; the activity was eluted in the correct position for promethium, between neodymium and samarium which were added for comparison and determined spectroscopically. The decay has been followed through four periods to give a half-life of 285 ± 3 days. A study of the radiations by aluminum, beryllium, copper, and lead absorbers, and a simple magnetic spectrometer, showed the radiations to consist of L and K x-radiation with a γ ray of 0.95 Mev. Assuming counting efficiencies of 20, 0.5 and 1%, respectively, for these radiations in the standard mica window argon-alcohol filled counters used, with fluorescence yields of 0.5 and 0.8 for L and K x-radiation, respectively, the approximate ratios of the radiations are: L x-ray: K x-ray: 0.95 Mev γ ray = ~0.4: 1: 0.3. The yields at various bombarding energies based on the measured K x-radiation are in agreement with formation by α,2n reaction and allocation to mass 143; the abnormally long half-life for an isotope in this position is probably due to the fact that Pm^{143} has a closed shell of 82 neutrons.

Samples of praseodymium were studied within 15 min after α-particle bombardment; no activities of half-lives greater than ~5 min, other than the long-lived promethium were observed. No α-particle emission has been found in any samples.

5331 Coincidence Studies of the Disintegration of Sc^{44}. William H. Cuffey. Phys. Rev. 79, 180-1(1950) July 1 (Letter to the editor).

A positron energy of 1.54 Mev was found, by absorption, for the 4.1-hr period of Sc^{44}. From β-γ coincidence measurements it appears that a 1.18-Mev γ ray is in coincidence with the positrons. The Sc^{44} was obtained by bombarding separated K^{41} with 23-Mev α particles.

5332 Gamma Rays from Thulium-170. P. J. Grant. Nature 165, 1018(1950) June 24 (Letter to the editor).

Gamma rays from Tm^{170}, in a brass capsule, were absorbed in gold and in lead, the photoelectrons being measured in a β-ray spectrometer. These indicated a γ ray of 198 ± 2 kev. A group of Compton electrons from the brass indicated another at 360 ± 10 kev. A second group was due either to a γ ray at a 550 kev or to Bremsstrahlung.

5333 Nuclei of Mass Number 10. Robert Bouchez and Roger Nataf. J. phys. radium 11, 266-70(1950) June (in French).

The β disintegrations of Be^{10} and C^{10} have been studied applying the new ΔJ and ΔL selection rules which the authors established (Compt. rend. 230, 440,532(1950)), using the "quasi-atomic" model of the nucleus. The Be^{10} and C^{10} disintegrations are analyzed in the following manner:

$$Be^{10} - B^{10} \quad \begin{cases} {}^1S_0 \xrightarrow{\beta^-} {}^3D_3 \\ {}^1S_0 \xrightarrow{\beta^-} {}^1D_2 \xrightarrow{\gamma} {}^3D_3 \end{cases}$$

$$C^{10} - B^{10} \quad {}^1S_0 \xrightarrow{\beta^+} {}^3S_1 \xrightarrow{\gamma} {}^3D_3$$

The authors show further that the following relations exist between the binding energies of nucleon pairs occupying the 2p level in the ground state of Be^{10}, B^{10}, and C^{10}: (p↑ p↑) ≃ (n↑ n↑) (Kemmer's rule) and (p↑ n↑) − (n↑ n↓) ≃ 2 Mev, which

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is exactly the difference between the $^3S_1$ and $^1S_0$ of the deuteron. (auth)

5334 Radioactive X-ray Emitters. M. L. Pool. Helv. Phys. Acta 23, Suppl. 3, 178-86(1950).

The half-life of about 200 x-ray emitting nuclei which decay by K-electron capture or by an internal conversion γ-ray process is listed. More detailed information is given on A^{37}, Ge^{71}, Pd^{103}, Rh^{103}, $Cb^{92,95}$, Mo^{93}, Cd^{107}, and Cs^{131}.

5335 A Contribution to the Study of the System Neutron-Proton. M. Demeur. Physica 16, 353-8(1950) Apr.

The Rarita-Schwinger potential has been investigated with a variable range for the tensor forces, the fourth parameter being adjusted to the magnetic moment of the deuteron. If the width of the well of the central forces is 2.8×10^{-13} cm, the only solution is that from Rarita and Schwinger (Phys. Rev. 59, 436(1941)), and the inferior limitation for the width of the well of the tensor forces is 2.66×10^{-13} cm. The cross section for n-p scattering (kinetic energy of the neutron: 50 Mev) has been calculated in the common Rarita-Schwinger theory with neutral and symmetrical isotopic dependences. The results are:

Neutral	$S = 0.3458 \times 10^{-24}$ cm^2	A = 0.7867
Symmetrical	$S = 0.1442 \times 10^{-24}$ cm^2	A = 6.07

(auth)

5336 Masses of Fundamental Particles. G. Stephenson. Nature 165, 1018(1950) June 24 (Letter to the editor).

The empirical relationship

$$\left(\frac{M_1}{m}\right)^2 \left(\frac{M_1}{m} - \frac{M_2}{m}\right) = 2 \times 137^3$$

has been found between the masses M_1 and M_2 of the fundamental particles and the electron mass m. It is satisfied by the neutron (M_1 = 1839.08 m) and neutral H atom (M_2 = 1837.56 m), and by the π meson (M_1 = 281 m) and μ meson (M_2 = 216 m).

5337 On an Approximate Solution of the Many-Body Problem of Fermi-Dirac Particles. Mokichiro Nogami. Prog. Theor. Phys. (Japan) 5, 65-71(1950) Jan.-Feb.

The strong coupling between the motions of individual nucleons makes it difficult to solve the nuclear many-body problem on a rational quantum-mechanical basis. A method of solution is given for the Schroedinger equation for the interacting Fermi-Dirac particles; the essential assumption of the method is not the weak interaction of the usual perturbation theory but the large total number of particles. The energy of the ground state comes out to be very similar in expression to the usual second order result of perturbation theory. The results are discussed in connection with heavy nuclei.

5338 On the Lattice Polarization Induced by Electronic Motion. Mokichiro Nogami. Prog. Theor. Phys. (Japan) 5, 56-64(1950) Jan.-Feb.

A quantum-mechanical perturbation calculation is developed for the reaction of the lattice polarization on electronic motion and it is found that the mechanism of the electron

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trapping in a perfect ionic lattice as proposed by Landau, (Physik. Z. Sowjetunion 3, 664(1933)) and by Gurney and Mott (Proc. Phys. Soc. (London) 49, 32(1937)) is also expected from this quantum-mechanical viewpoint, though the result is not in perfect agreement with that of the foregoing authors. Further, the influence of the lattice polarization on the probability of electronic transitions which take place in an ionic lattice has been examined with two examples and it is pointed out that such influence cannot be always accounted for by the simple phenomenological introduction of an empirical dielectric constant. (auth)

5339 On the Nuclear Forces. Hiroshi Enatsu. Prog. Theor. Phys. (Japan) 5, 102-16(1950) Jan.-Feb.

It is shown that the expressions for nuclear forces, in symmetrical and charged cases, are the same for mixed meson theory and spin 0 meson field as they are for neutral vector meson theory. The well-known difficulty of the potential at the origin is still present, but otherwise the theory of nuclear forces is thought to be brought into more satisfactory form.

5340 Physics and Radiation. Philip M. Morse. Am. Scientist 38, 390-8 (1950) July.

This is a very readable account of the rise of field theory and its disappointing failure, so far, to clear up the complex picture of atomic and sub-atomic phenomena. Many of these can be satisfactorily computed by the present field theories but all the theories show internal inconsistencies and unsatisfactory infinities. The present is described as an exciting time for experimentalists, as more, better, and different kinds of experimental results are needed to build on, but an uncomfortable time for theorists since each new phenomenon creates more infinites to deal with.

5341 The Radiation Constants and the Light-Equivalent of Energy. W. de Groot. Physica 16, 419-20(1950) Apr. (Letter to the editor).

It is shown that the discrepancy between the theoretical value for the light-equivalent of energy (K = 683 lm/W) and the experimental values (K = 628 or 640 lm/W) may be traced to the figure for the melting point of gold. This figure appears in the theory and the indication is that it should be a few degrees higher than the present accepted value.

5342 The Theory of Groups and Quantum Mechanics. Hermann Weyl. New York, Dover Publications, 1949. 422p.

The author postulates the importance of the theory of groups in discovering the general laws of quantum theory. Showing how concepts arising in the theory of groups find their application in physics, he illustrates his argument with many examples. Included are discussions of Schroedinger's wave equation, de Broglie's waves of a particle, the Jordan-Holder theorum and its analogs, Burnside's theorem, Lie's theory of continuous groups of transformations, the Pauli exclusion principle and the structure of the periodic table, quantization of the Maxwell-Dirac field equations, and Young's symmetry operators.

5343 The Theory of Nuclear Reactions. J. Blatt and V. F. Weisskopf. M.I.T. Laboratory for Nuclear Science and Engineering Technical Report No. 42, May 1, 1950. 243p. (AEC File No. NP-1587.)

This report contains a preliminary draft of two chapters on nuclear reactions of an unpublished book on Theoretical Nuclear Physics by J. Blatt and V. F. Weisskopf. Part I covers the general theory of nuclear reactions, and Part II covers application of the theory to experiments.

5344 The Study of Surface Processes with Radioactivity. Hans Frauenfelder. Helv. Phys. Acta 23, No. 4, 347-80(1950) (in German).

A short survey of surface processes on solids is given. New methods for measuring desorption probabilities, sticking coefficients, and surface diffusion coefficients by means of radioactive substances are described. Recoil atoms from ζ capture are recorded; this allows the measurement of the adsorption of thin gas layers at low pressures and of extremely small diffusion coefficients. Experimental results are given and compared to former investigations with other methods. Applications to nuclear physics are the rapid separation of radioactive elements and the preparation of very thin sources.